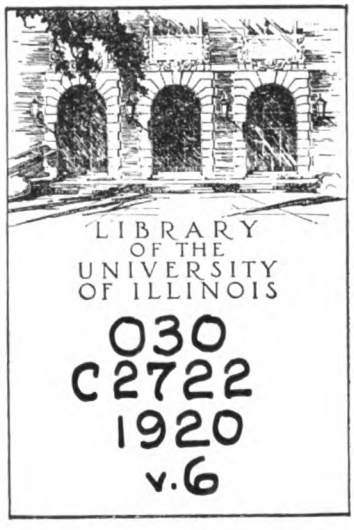
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VOLUME VI

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CONTRIBUTORS TO THIS VOLUME

Art and Music

J. G. B. L. *J. G. Bohun Lynch*

Business and Commerce

A. B. *Arthur Brooke*
A. C. M. *A. C. Marshall*
F. H. *Frederick Heelis, F.C.I.S.*

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English Language and Literature

J. D. *John Derry, J.P.*
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W. H. K. *W. H. Koebel*

Geography

C. J. S. *C. J. Silverston, B.Sc. (Lond.)*

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D. W. C.-J. *D. W. Carmalt-Jones, M.A., M.D.(Oxon.)*
E. W. E. *E. W. Edmunds, M.A., B.Sc.(Lond.)*
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L. M. P. *L. M. Parsons, M.Sc., D.I.C., F.G.S.*

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ENGLISH LANGUAGE AND LITERATURE:

Contributors:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

NINETEENTH CENTURY POETRY.—I

BOTH in style and subjects the English poetry of the early part of the nineteenth century broke away from the classical models of the later seventeenth century and the early eighteenth century. In style it attained far greater variety and pliability, and many of its subjects, already introduced by such writers as Cowper, cannot be associated imaginatively with such writers as Dryden, Pope or Johnson.

Literary Freedom

Because this nineteenth century poetry from the first is humanised broadly in spirit, and has gained ease and freedom in style, it remains modern to this day. Reading back to Dryden or Pope, or even to Goldsmith, we are conscious of entering, in a literary sense, into a rather precise and regularised past, ruled by the somewhat negative virtues of clearness and restraint; but that feeling disappears in the presence of the confiding Nature-worship of Wordsworth, the bustling story-telling of Scott, the transcending idealism of Shelley, the defiant taunts of Byron, and the frank revelations of the inner self of later poets like Tennyson.

Poetry here has left the library, the stage, and "the town," as artificial life was called, and has taken the whole realm of life, thought, and the universe for its province. This liberation and breadth gave it a freshness that still persists.

William Wordsworth, who by almost universal assent takes rank among English poets next to Shakespeare and Milton, was born at Cockermouth, in Cumberland, on April 7th, 1770. His father, an attorney, and agent for the first Earl of Lonsdale, died when the poet was thirteen years old, leaving four sons and a daughter. The children's mother had died when William was eight, and the family was brought up chiefly by their grandparents. They were not sympathetically understood by their elders, but were sustained by a great mutual love. This was specially true of William and his brilliant, though modest, sister Dorothy.

Wordsworth's Childhood

The Earl of Lonsdale refused to pay a debt of five thousand pounds owing to the family, and in consequence the early life of the children had the bareness and simplicity of the peasantry of their native dales. Through these dales and over the flanking fells they rambled freely while the boys were attending the little grammar school at Hawkshead, and even in those early days to one of them

> "poetic numbers came
> Spontaneously to clothe in priestly robe
> A renovated spirit."

In 1787 William followed his older brother to Cambridge, but his studies there were somewhat desultory, and in 1791 he took an ordinary degree, after spending the previous summer tramping with a Welsh college friend through France and Switzerland into Italy. Next year Wordsworth was again in France for a lengthy stay, an enthusiastic sympathiser with the Revolution.

On his return he published in 1793, without immediate success, his *Evening Walk*, brief pictures of lakeland scenes, and *Descriptive Sketches* outlining his walking tour.

The companionship of his sister Dorothy, whose instinct for observation was perhaps swifter than his own, and quite as sure, now became an inspiration, and he began to regard himself as a spirit consecrated to the poetic interpretation of Nature. After some comparatively aimless years during which he was writing simple poems of peasant life, usually tragic in tone, Wordsworth, with Dorothy, was enabled, through a small legacy left by a friend, to settle in Somersetshire.

Lyrical Ballads

There he made the acquaintance of Samuel Taylor Coleridge, who had followed him as a student at Cambridge, and had read his *Descriptive Sketches*. Coleridge was living in genteel poverty at the foot of the Quantock Hills, and when the acquaintance had ripened into friendship the Wordsworths removed to the same neighbourhood.

The influence of the poets on each other, and Dorothy's influence on both of them, proved stimulating in a high degree. They were afire with the love of Liberty, and Wordsworth was possessed by a theory of Revolution which was to be applied through poetry. He thought to move the hearts of men by simple pictures of the lives of the poor traced in natural language and casting off the bonds of artifice with which Pope and his school had hampered the national poetry. To this end the poets agreed to publish a joint volume, and in 1798 appeared their *Lyrical Ballads*, marking a turning point in English literature.

Coleridge's principal contribution was the eerie ballad *The Ancient Mariner*, the rarest flowering of his genius. Wordsworth's pieces here and there went beyond the verge of simplicity into puerility, and the critics hastened to ridicule him, but even his lapses into doggerel, in the name of naturalness, were followed quickly by spontaneous interpretations of nature from " a heart that watches and receives."

After the publication of the *Lyrical Ballads* the Wordsworths and Coleridge visited Germany, and on their return the brothers and sister settled in the Lake District, at Dove Cottage, Grasmere, while Coleridge lived at Keswick. In 1802 Lord Lonsdale died, and his heir paid the family debt with interest, so that their poverty, bordering on penury, was relieved, and the poet, having discharged obligations he had incurred in France, was able to marry his old playmate, Mary Hutchinson.

He now began to write sonnets, a form of verse that aptly suited his genius. Three of his finest sonnets, *On Westminster Bridge, It is a Beauteous Evening Calm and Free*, and *Milton, Thou Shouldest Be Living at this Hour*, were written when he was travelling with his sister to France to clear up the business which preceded his marriage. Visits to Scotland followed, and led to a lifelong friendship with Scott, who had not then published his *Lay of the Last Minstrel*, and was only known as a student and writer of ballads.

The friendship with Coleridge was now strained by the growing enslavement to opium which so tragically obscured that master mind. In the years following his marriage Wordsworth was busy writing many of the shorter poems that have placed him among the immortals. His Odes *To Duty* and *On Childish Intimations of Immortality* belong to this period. They were published in 1807 with some of his most exquisite lyrics.

The Solitary Reaper

His Scottish visit produced, for instance, the perfect poem, *The Solitary Reaper*, unsurpassed in the world's literature for simplicity, melody and poetic glamour.

Behold her, single in the field,
Yon solitary Highland lass!
Reaping and singing to herself;
Stop here, or gently pass!
Alone she cuts and binds the grain,
And sings a melancholy strain;
O listen! for the vale profound
Is overflowing with the sound.

No nightingale did ever chaunt
More welcome notes to weary bands
Of travellers in some shady haunt
Among Arabian sands.
A voice so thrilling ne'er was heard
In spring-time from the cuckoo-bird,
Breaking the silence of the seas
Among the farthest Hebrides . . .

While the *Poems in Two Volumes* of 1807 were being composed Wordsworth was

planning his masterpiece—as he conceived it —to express his view of Nature and Man and the influence of Nature on Man. The work was never completed. An elaborate introduction entitled *The Prelude*, designed to picture the growth of the poet's mind in preparation for his task, was finished in 1805, though not published before 1850.

The Excursion (1814) was a part of the larger scheme. A fragment begun under the main title, *The Prelude*, was not printed till 1888. But the scheme was destined to fail. The plan was too vast; the poet's impulse was exhausted and his mind had changed on many subjects before he confronted his central task.

Nearly all Wordsworth's most distinctive work was done between the ages of twenty-eight, when he wrote his *Lines on Tintern Abbey*, and thirty-five, when he wrote the ode on *Intimations of Immortality*. Afterwards he was constant in his regrets that the youthful glamour of life had disappeared, as indeed it had, for his disillusionment with the French Revolution had changed him from a democrat inclined towards revolution into a steadily deepening toryism.

From the portrait by Peter Vandyke, in the National Portrait Gallery.

SAMUEL TAYLOR COLERIDGE (1772-1834),

who but for irresolution and opium might have become an even greater poet than he was.

In 1813 the poet moved to Rydal Mount, where he lived for the remaining thirty-seven years of his life. In the same year he was appointed Distributor of Stamps for Westmorland, and his financial circumstances became easy. He resigned the office to his son in 1842, and was given a civil list pension of three hundred a year.

In 1843 he became poet laureate in succession to Southey. Critical opinion had long held him to be the greatest poet of his generation. He died on April 23, 1850.

From the portrait by Robert Hancock, in the National Portrait Gallery.

WILLIAM WORDSWORTH (1770-1850),

who takes rank among English poets next to Shakespeare and Milton.

Lord Morley regards the Ode *Composed on an Evening of Extraordinary Splendour and Beauty* as his last work of value. This was written in 1818. But the sonnets on King's College Chapel, Cambridge (1821), should surely be included, with their noble close:

> They dreamt not of a perishable home
> Who thus could build.

It needed, however, in these later years, some very powerful stimulus, such as Nature in her most gorgeous tints, to rouse the poet from a mere manufacture of rhyme.

Wordsworth's fame is built on *The Prelude* and *The Excursion*, his miscellaneous poems and his sonnets written before 1807, with accessory distinction from *Laodamia* and *The White Doe*. All else lacks the spontaneous charm of the poet's rarest moods. *The Excursion* became a receptacle for some of his earlier narrative poems. In it he developed his sense of Nature bringing the soul of man into unison with the Divine Power.

Wordsworth's whole life was the life of a

poet, great during its period of youthful impulse, but sinking slowly towards the commonplace. His influence on the poetry and thought of the nineteenth century, and on the attitude of men towards Nature, was immense. As a spirit dedicated to interpretation of Nature he fulfilled his mission with a splendid amplitude.

Rest was the gift he gave ; and *Peace* the shade
He spread, for spirits fevered with the sun.

Samuel Taylor Coleridge was born at Ottery St. Mary, Devonshire, on October 21, 1772, the son of the vicar, the Rev. John Coleridge. On the death of his father, the boy, aged nine, was sent to Christ's Hospital School, London, where Charles Lamb was his junior by rather more than two years. A brilliant though desultory scholar, Coleridge won his way to Cambridge by scholarships, in 1791. When he was twenty-one he enlisted as a dragoon, but was bought out and returned to Cambridge, where, however, he did not take a degree.

Before leaving Cambridge he came under the influence of Robert Southey, an Oxford student. Irresolute and impractical, Coleridge throughout his life needed someone on whom to lean. For several years, from 1794 onward, Southey was his stay, and then Wordsworth. With Southey and other young friends a scheme was planned for emigrating to America and forming a socialistic settlement, and as part of the arrangement Southey, Coleridge and a friend named Lovell married three sisters ; but the scheme broke up with the death of Lovell in 1796.

Meantime Coleridge published *Poems*, and an unsuccessful play, and partly supported himself by lectures and by preaching in Unitarian chapels. His early poems, reminding the reader of the allegorical impersonations of Gray, have no distinctive quality. Then, and later, it was his talk that made his reputation, and won friendships which enabled him to live. Cottle, a Bristol bookseller, Poole, a Somersetshire tanner, and the Wedgwoods, the Staffordshire potters, befriended him financially, feeling that they were enabling genius to find expression.

It was, however, the poetical afflatus of Wordsworth, who came into close touch with him in 1797, and Wordsworth's brilliant and stimulative sister Dorothy, who liberated and directed his creative imagination. He was living at the time at Nether Stowey in

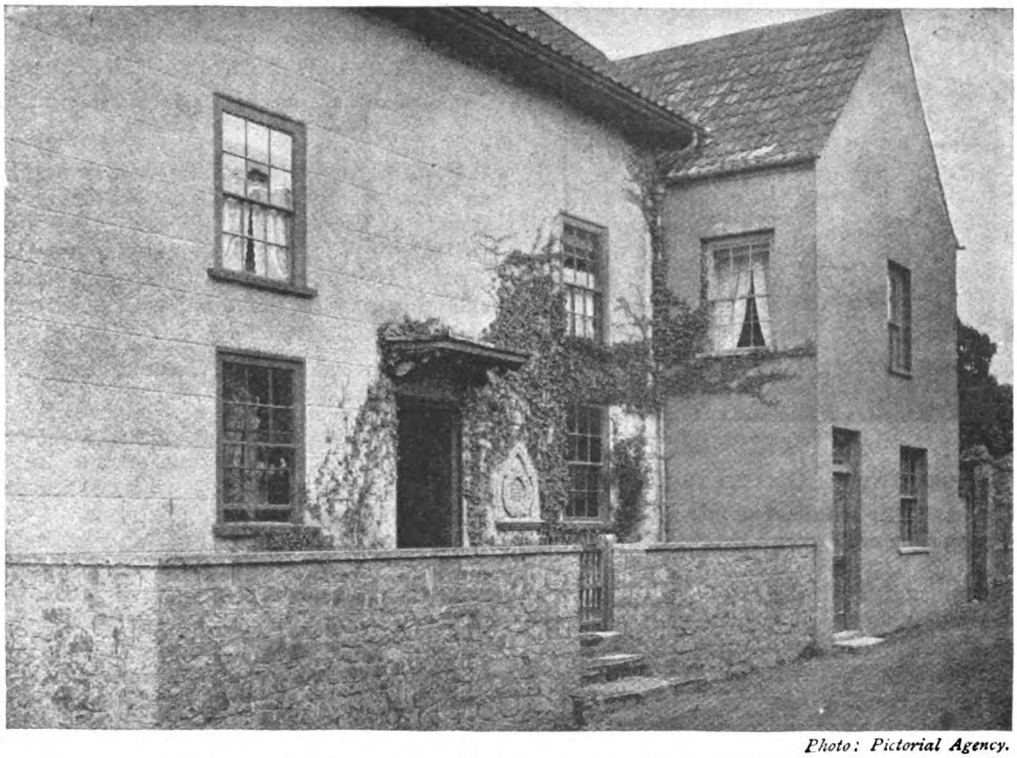


Photo: Pictorial Agency.

COLERIDGE'S COTTAGE AT NETHER STOWEY, SOMERSETSHIRE,
where the poet wrote the *Ancient Mariner*, an effort of creative imagination unique in English literature

Photo: G. P. Abraham.

WORDSWORTH'S LAKE-LAND HOME,
where the poet settled soon after the publication of *The Lyrical Ballads*.

Somersetshire, in a cottage provided for him by Poole, the tanner, and the Wordsworths came to live at Alfoxden, three miles away. Here were planned and written *The Lyrical Ballads*, which are the fountain head of the stream of poetical romanticism which refreshed the literature of the nineteenth century.

Coleridge's only contribution to the *Ballads* was his *Rime of the Ancient Mariner*, but that was by far the most original poem in the volume. A sheer effort of creative imagination, in an atmosphere of half-light supernaturalism, with a tender under-current of humane purpose, it is marvellous in its sustained consistency as it voyages through a realm of eerie fancy without ever quite losing touch with realities. It is all pure poetry, including the explanatory annotations in prose form. Indeed the purest serene of loveliness is reached in one of these prose accompaniments. Says the rime—

> The moving Moon went up the sky,
> And no where did abide:
> Softly she was going up,
> And a star or two beside.

And the prose reading of the mariner's mind is: "In his loneliness and fixedness he yearneth towards the journeying Moon, and the stars that still sojourn, yet still move onward; and everywhere the blue sky belongs to them, and is their appointed rest, and their native country and their own natural home, which they enter unannounced, as lords that are certainly expected and yet there is a silent joy at their arrival."

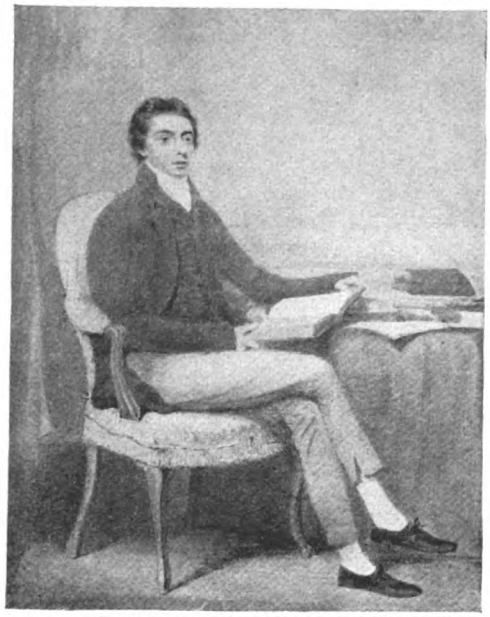
What worlds away from the formal poetry of artificial society, that had satisfied the century before Coleridge, was this felt kinship with Nature, and the Mariner's teaching of "love and reverence for all things that God made and loveth"!

To the same period when Coleridge wrote his *Rime of the Ancient Mariner* belong his other poems of greatest note—*Christabel* and *Kubla Khan*, with their liberation of verse from the trammels of a dull regularity and the substitution of a changeful verbal melody. *Christabel*, begun in Somersetshire, remained a fragment, as also did the dream poem *Kubla Khan*, remembered after waking. The most frequently quoted of Coleridge's poems, the *Hymn before Sunrise in the Vale of Chamouni*, based in part on a brief German poem, was also of an early date.

From 1797 to 1802 was the flowering

period of Coleridge's choicest mind. In the latter year he wrote his *Ode to Dejection*, lamenting his loss of poetic impulse. Afterwards his life, particularly when he had drifted away from the Wordsworths, became a prolonged tragedy, strewn plentifully with fragments of philosophy and criticism, but no distinctive verse, and no finished work of any kind.

Between the years 1804 and 1816 Coleridge lived a wandering life, his wife and children being left at Keswick with Southey. During this period he was a victim of the opium habit, which weakened a character already predisposed to irresolution. For over two years he was abroad, at Malta and in Italy; later he resumed, in a desultory way, a connexion with the London newspaper press which he had formed about the date of the *Lyrical Ballads*; he lectured in London from time to time; published a paper called *The Friend* in 1809-10 during a return to the Lake District; had his play *Remorse*, written long before, staged with success at Drury Lane in 1813; and finally, in 1816, placed himself as a guest in the house of Mr. Gillman, a North London doctor, who gradually helped him to combat the demoralising drug habit.



From the portrait by Henry Edridge, A.R.A., in the National Portrait Gallery.

ROBERT SOUTHEY (1774-1843), **who, with Wordsworth and Coleridge, completes the trio of "Lake Poets."**

After this the poet lived over eighteen years—the most happy years of his life, with the exception of the short Somersetshire episode when poetic invention abounded and hope had not suffered eclipse. At Highgate, with Mr. Gillman, he was industrious by fits and starts, but though he did not complete any of his literary schemes, and was often only an aimless wanderer in the maze of metaphysics, his fame spread, and the impression of his greatness felt so strongly by most of his listeners who sought his company, became a tradition. Thinkers, like Emerson, came to see him from afar. His friends were many, and, notwithstanding disappointments, faithful, so that when he passed away on July 25, 1834, he went in honour, his faults extenuated.

Robert Southey (1774-1843) has been regarded as completing, with Wordsworth and Coleridge, the trio of "Lake poets," but his association with the other two as a poet, apart from his residence in the Lake District, was slight. He was born in Bristol, August 12, 1774, and so was nearly two years younger than Coleridge, and more than four years younger than Wordsworth. His education, though he was at Westminster School and Balliol College, Oxford, was chiefly by omnivorous reading begun in infancy. At the age of eight he had read Shakespeare.

In youthful exuberance before he was twenty he had written, under the influence of the French Revolution, a three-act drama on Wat Tyler and an epic on Joan of Arc. The *Joan of Arc*, published in 1795 eventually reached a fifth edition, and confirmed its author in the belief that primarily he was a poet.

Under the influence of Coleridge he became a temporary believer in the republican Socialism which they named "pantisocracy," and they married sisters as an instalment of their plan. Both, however, like their friend Wordsworth, drifted far away from such beliefs, and Southey became as strongly conservative as Wordsworth, and much more violent.

In 1795 he went to Portugal and laid the foundations of a mastery of the Peninsula languages and literatures which did much towards shaping his later literary life. After a second visit to Portugal he settled, in 1803, at Keswick, and made writing his life-work.

Like Wordsworth and Coleridge he won friends who helped him financially, one from his college circle giving him £160 a year until he received a Government pension of £200 a year, that later was increased to £300. His chief resource was articles in the Tory *Quarterly Review*. In biography he de-

veloped a finely balanced narrative style which now is the surest preservative of his name. It is illustrated best in his lives of Wesley, Bunyan, Cowper, and, above all, Nelson. In a heavier manner he wrote a *History of Brazil*, the first section of a designed but unfinished *History of Portugul*, and a *History of the Peninsular War* that was outclassed by Napier's brilliant story. His Spanish translations included *The Chronicle of the Cid*.

These were the chief labours of a man who believed that his real mission was to write epics in experimental verse. When a boy he conceived the idea that each of the great religions might furnish an epic from its mythical stories, and he set himself the task of writing these unwanted epics. Thus his *Thalaba the Destroyer* (1801) was based on Mohammedanism; his *Curse of Kehama* (1810) on the Hindoo mythologies; and in his *Madoc* (1805) he accompanied a fanciful Welsh chieftain to the New World to conquer the Aztecs, and study their religion.

Though Southey had a natural love of romance, and a ready command of poetical rhetoric, he handicapped himself fatally by ill-chosen subjects, presented through unsuitable measures—usually blank verse, or other unrhymed metres—and in consequence the poems he hoped were masterpieces are dead, and their author only lives through his graceful prose in biography, and his familiar verse for children in a charmingly simple style, of which the *Battle of Blenheim* is the most perfect example. J. D.

POLITICAL ECONOMY.—III

LABOUR as an agent in the production of wealth or for the increased production of wealth is also entitled to a share in the wealth produced.

Labour, as we have already seen, embraces all kinds of ability. There is the "directive ability" which is often described as "mental ability" as well as the manual labour.

Almost all commodities pass through many complicated processes before they become serviceable to man, each of which necessitates many kinds of labour. It is only necessary to suggest to the student to trace for himself the many processes and the varied kinds of labour bestowed on any article of everyday use to appreciate this.

Take for example the cotton seed sown in America and the varied kinds of labour which is employed before the finished cloth is produced in the Lancashire mills to be placed on the markets of the world.

Labour does not cease even with the production of the finished cloth, the markets must be found, and then comes the work of distribution of the commodity.

In addition to the two main divisions of labour—mental and physical—there is a further division.

Productive and unproductive labour. By productive labour we mean not only the actual labour employed in producing commodities, but all those who are employed in transporting the commodities from one place to another. They confer upon commodities the utility value, the convenience in distribution, the army and navy and the police the utility of security, the commercial traveller and the advertisement contractor the value in exchange.

Productive Labour

The older school of economists were inclined to regard much of the labour employed as unproductive which we now regard as productive. An instance of this is the schoolmaster, and those who provide amusements and education. It was not thought at all necessary to provide the manual labourer with education; it was considered that an uneducated man was proved as efficient a manual labourer as a fairly educated man.

Now, however, we have come to think that a properly developed mind is as essential as a well-developed body, and many are now agreed that labour devoted to providing education, pleasure and relaxation adds to the productiveness of labour and therefore should not be deemed as unproductive.

Fawcett defines productive labour as "that which produces utilities fixed and embodied in material objects."

This definition, however, is now regarded as far too limited, but no economist has as yet given a definition which will embrace the doubtful occupations.

The tendency is to regard as unproductive labour only that labour which is expended, for example, in such abortive undertakings as mines which yield no return, railways which are not completed, and building projects which are abandoned on the one hand; and, on the other, labour used to supply the luxuries in the way of personal service and which in no way adds to the national wealth.

The share of labour is called wages. In theory wages are governed by supply and demand, or some state by the "lowest subsistence level"; but since the growth of

trade unions the tendency has been more and more to regulate the wages of manual labour by production, or as some assert to regulate production to the level of wages.

There is no doubt that at one time labour suffered and indeed was oppressed, but sweated labour, although far from being blotted out, has decreased by the combination of the workmen and by legislation.

Some economists, as we have already seen, only admit labour as the source of wealth, while others assert that it is labour applied to land which produces wealth. Few, however, will deny that capital is entitled to be included as an agent of production, and is entitled to its share whether it is owned individually or collectively.

Capital Defined

What, then, is Capital ? Professor Symes defines it " as any products of labour which are devoted to the production of wealth " ; while Fawcett defines it as " Wealth which has been accumulated with the object of assisting production." A comprehensive definition, however, would be "That portion of wealth which has been set aside for the production of further wealth," and is the result of abstinence, toil and thrift.

Capital is often spoken of as if it were synonymous with money. This is an erroneous idea. The quantity of capital is measured in money terms, but capital embraces not only the wage fund out of which labour receives its reward, but machinery, implements and plant of all description.

Capital is said to be of two kinds, fixed capital and floating capital. The fixed capital consists of the buildings, machinery and anything which is of a durable nature.

Floating Capital or Circulating Capital is the capital employed in any industry which provides the food of the labourers and performs its functions once.

A little consideration will suffice to show the necessity of capital to production. In the agricultural industry it is necessary to set aside a certain amount of the crop as seeds, to provide the implements and also to provide the wages of labour. It is obvious that the labourer cannot live on the crop he is assisting to produce and which will not be ready for consumption for many months after it has been sown.

The coal miner does not accept a certain quantity of the coal he produces as his share. Such a system would be cumbersome and inconvenient. He is therefore paid his wages at regular intervals irrespective of whether the coal has been exchanged or not. The Capitalist therefore steps in and provides the fund from which wages are paid, and in return for this he claims a share in production.

Some of the leading economists prefer to leave the definitions and considerations of value as one of the last subjects to be dealt with, but it appears to us that having given an outline of wealth, the sources of wealth, and its production and distribution, it will be convenient to ascertain what we understand as the value of what has been produced.

The student must not confuse the words *value* and *price* because, as we shall see, there is a scientific meaning attached to the word value which in ordinary language does not exist.

According to economists the word value is used to denote Value in use, Value in Exchange.

Adam Smith points out that Value has two distinct meanings. Sometimes it expresses the utility of some particular object, and sometimes the power of purchasing other goods with the possession of that object.

The best opinions, however, appear to be agreed that there are three distinct things signified by the term value: (1) inherent utility; (2) cost of production; (3) purchasing power.

Value and Price

McLeod defines value as follows: " the value of any economic quantity is any other economic quantity for which it can be exchanged."

Ruskin in *Munera Pulveris* says that, " The reader must, by anticipation, be warned against confusing value with cost or with power. Value is the life-giving power of anything, cost the quantity of labour required to produce it; price the quantity of labour which its possessor will take in exchange for it . . . The production of effectual value, therefore, always involves two needs : first, the production of a thing essentially useful ; then the production of the capacity to use it."

The fundamental sense of value is utility estimated or measured by some standard, and the standard of economists is power of purchase. Therefore we may take it that the value of any commodity is ascertained by comparison with another commodity. Value is therefore a relative expression.

Price is the measure of value as expressed in money. The price of a commodity may therefore be defined as its " value " when

From the picture by Sir H. H Johnston.

ACHILL ISLAND, OFF THE WEST COAST OF IRELAND,

after centuries of buffeting by the Atlantic, affords a remarkable example of marine denudation (*see* Vol. V., p. 452). **The cliffs here shown are really the rib bones of Mount Croachaun (2,219 feet).**

estimated by comparison with gold or silver, or any other forms of currency which have been adopted as money, but we still have the same element of comparison as before because the measure of "value" is expressed in money terms for all commodities.

The value of a commodity varies; sometimes there is an increased value because there is a scarcity of that particular commodity; or it may increase in value owing to the decrease in value of another particular commodity, of which there has been overproduction. There is no such thing as a general rise in value of all commodities, although there may be a general rise in prices.

A general rise in values would imply that all commodities will exchange for more of all other commodities, which is as absurd as saying that any man is taller than every other man.

Labour and Value

When there is a rise in value of any commodity there is a corresponding fall in the value of some other commodity. Let us take an example.

We will assume that three pounds of tea is the value of one sack of oats; if there is a general rise in value, three pounds of tea would still be the value of the sack of oats. So there would be no rise at all, but if three pounds of tea would exchange for two sacks of oats there would be a rise in value of tea and a decrease in value of oats.

Let us now ascertain what creates or makes value (eliminating for the time being all question of price from our minds), and we shall see that labour is a prominent factor, but not the only factor.

Adam Smith says: "The value of any commodity to a person who possesses it, and who means not to use or consume it himself but to exchange it for other commodities, is equal to the quantity of labour which it enables him to purchase or command. Labour therefore is the real measure of the exchangeable value of all commodities."

Here it will be observed that Adam Smith specifically confines himself to commodities which are to be exchanged, and proceeds to deal with the value from the point of view of exchangeability for another commodity, by which he measures the value—not the labour expended on the particular article he exchanges.

Let us take an example. A possesses a table which has occupied 10 hours in making; B has 4 chairs which have occupied 20 hours in making. A exchanges his 1 table for B's 4 chairs. According to Smith the value of A's table is not the 10 hours labour expended on making it but 20 hours, the time expended by B on the 4 chairs for which he exchanged it.

Ricardo does not agree with Smith, but asserts that the value of a commodity is the cost of production of that commodity.

Karl Marx contends that "a use value or useful article therefore has value only because human labour in the abstract has been embodied or materialised in it. How then is the magnitude of this value to be measured? Plainly by the quantity of the value creating substance, the labour contained in the article. The quantity of labour, however, is measured by its duration, and labour time in its turn finds its standard in weeks, days and hours."

"Commodities therefore in which equal quantities of labour are embodied or which can be produced in the same time have the same value. As values all commodities are only definite masses of congealed labour time."

Three Classes of Values

Professor Fawcett divides values into three classes:—

(1) Those which possess a monopoly value and whose supply cannot be increased. In this class are included works of art, the pictures of deceased artists, sculptors, articles of virtu, rare coins, shops and houses in particular localities and other articles where no effort can increase their number.

(2) Those whose cost of production increases as an additional supply is produced. In this class are included agricultural produce and minerals where the area of supply is limited and are the principal examples.

(3) Those whose supply can be increased without increasing the cost of production. In this class may be included almost all manufactured commodities.

In considering the value of a picture by a deceased artist, it cannot for a moment be contended that its value is represented by the number of hours spent in its production. A Morland, for instance, was often exchanged by the artist for his board and lodgings for a very limited period, but the same picture to-day would exchange for a thousand times its original value as represented by the labour employed in producing it.

The value of commodities under the first class then acquire their value from the limited supply, or the difficulty in obtaining

it, and the effectual demand by persons who have a use or a desire for the article. These elements are always present whenever an article has an exchange value.

Some economists contend that articles of virtu, pictures and precious stones have no use value. It is, however, generally admitted that every article which has a practical use or gratifies some desire has a use value. A diamond is prized not only because of its scarcity or that it is difficult to obtain, but because there is a demand for it as an ornament, and as an ornament it has its " use value " as satisfying a desire.

It is not valued by the number of hours spent in discovering it, or we might find a diamond of 2 carats of greater value than a stone of 20 carats. It is the effectual demand for an article limited in quantity which creates the value.

We come now to the second class of commodity—commodities of which the cost of production increases with the supply.

Population and Food Supply

As we remarked, this applies to agricultural produce more particularly. In a country like our own where the area from which food can be obtained is limited, an increase in the population tends to raise the value of food supplies. This is caused by the increased cost of production. Land which is fertile yields a good crop and requires less labour than unfertile land.

With the increase in population more wheat is required, and must be produced either from the land or by imports from foreign countries. There is the land which has not been hitherto cultivated to fall back upon. Some of the land is just on the margin of being fertile and is first utilised, but it requires more labour and additional capital to cultivate it, consequently the value of the wheat produced on this land once barren but now just over the margin, costs more and causes an increased value to produce, not only of that particular land but to all produce.

The same argument applies to minerals, more particularly coal and iron, which require deeper mines and workings: the cost of production naturally increases and the exchange value rises; such rise affects not only the coal which is obtained in the deeper working at an increased cost, but also all coal rises in value.

We may therefore take it that when the food supply is obtained from a limited area the growth of the population will increase the value, but this may be counteracted by political, economical and industrial changes such as have taken place in England.

The population increased so rapidly that it became necessary to import large quantities of foodstuffs from our Colonies, where agricultural resources were developed. The introduction of machinery, the improved and cheapened means of transport, have widened the area from which we draw our food supplies and reduced the cost of production.

The third class as denoted by Fawcett is manufactured commodities.

Although, as we have seen, labour plays an important part in the production of agricultural and mineral produce, nature also plays an important part, but in manufactured commodities the human element is the predominating factor.

The value of raw material forms a part of the value of manufactured articles, but what is truly raw material forms so small a part, that we may give labour and capital the credit of creating the exchange value in manufactured articles, and supply and demand the causes of fluctuation. Demand may create a scarcity of a particular article and as a result the price may temporarily increase, but the very fact of this increase in value would stimulate production, cause machinery to be introduced, reducing the cost of production and the exchange value.

The Function of Capital

One of the greatest factors in the production of manufactured articles, of course, is machinery, and as demand for a particular commodity increases, greater improvements are made in the machinery used and the cost of production is lessened. For it is a well known fact that machinery on a large scale works at a less comparative cost than machinery on a small scale.

Economies in working tend to reduce the exchange value of the commodity. This change, however, is not the immediate result, since the manufacturer must for a time work at a disadvantage. New hands have to be imported into the trade; they are less efficient than the skilled workman, and a sudden increase of unskilled labour generally results in a demand for higher wages by the skilled worker.

The factors governing the value of manufactured commodities to be considered are the wages of labour of all classes, that is, the manual labour and directive ability, the rent of factories, and the return on the capital, as it must be remembered that the machinery and the wage fund is provided by capital.

J. W. U.

Continued from Vol. V., page 444.

HISTORY:

Contributors:—J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.

THE RISE OF NAPOLEON

An upheaval like the French Revolution could not take place without affecting the other states of Europe. To liberal thinkers and to oppressed peoples it came at first as a beacon of hope; to autocratic governments it appeared as a profound menace. In the earlier revolutionary wars France was fighting a coalition of monarchs, alarmed for the stability of their dynasties; the French armies came at first as liberators. As the moral standards of the Revolution declined its armies degenerated into oppressors, and in the later Napoleonic campaigns the spirit of nationality and freedom was on the side of the Allies.

Eighteenth Century Europe

The eighteenth century in Europe was the age of the benevolent despots. Frederick the Great in his internal policy, Maria Theresa, her son Joseph II., the Empress Catherine of Russia, Gustavus III. of Sweden, were rulers of great ability and strength of character, who laboured hard and sincerely to promote the prosperity of their subjects. But while they looked on themselves as responsible for the good of the governed, they had no notion of admitting the people to any share in the government. There was little recognition of the principle of nationality. The political groupings were largely arbitrary, and there was no idea that the transfer of a province from one government to another affected anyone but the governments concerned.

The reforms of Joseph II. in Austria had rather weakened than strengthened the state owing to his lack of tact and his strong Germanising policy, while the abolition of serfdom had offended the Hungarian magnates. His brother Leopold, who succeeded him in 1790, did much to remove local disaffection, but the death of this enlightened and pacific monarch in 1792 left Austria in the hands of Francis II., a young and inexperienced ruler who was easily controlled by his reactionary and warlike councillors.

Germany was nothing but a geographical expression. The Empire included a great number of states, united by no feeling of common nationality. The leaders of thought and letters were more cosmopolitan than German. In all German states the government was despotic, and while in some cases the despotism was more or less benevolent, in others it was cruel and oppressive.

Prussian Prestige

In the east the lower classes were mostly serfs, wholly without personal freedom and far worse off than the French peasants. In the west, in the Rhine Valley, the condition of the peasants was better and there was a prosperous middle class. Prussia was still the most powerful state in Germany, but she was living on the prestige of Frederick the Great. The government was a pure absolutism. The nobles were as arrogant as the French, but less cultured. They retained their feudal rights. The mass of the people were serfs.

Switzerland presented a loose confederation of cantons, some of them democratic and some oligarchical in government. Holland was also a federation, bound together by the power of the Stadtholder, who was supported by England and France against his republican subjects.

The Scandinavian states had progressive rulers, and Russia was ably administered by the Empress Catherine. Serfdom was still in force, but the village organisation gave some protection to the peasants, and there was less discontent than in countries apparently more advanced. Poland was in the last stage of weakness and disorganisation.

Of the southern states, Spain and Portugal were enfeebled and decaying, and the condition of the lower classes in Spain worse than in France. Italy was divided into a

number of small states, some of which were well ruled by their princes, while others were very backward. The commercial republics of Venice and Genoa had fallen into decay. The condition of the people was tolerable in the north, but very bad in Naples and the south.

England stood somewhat apart. Her insular position had developed national consciousness, and her government, with all its defects, represented a far higher degree of political progress than any of the Continental states. Colonial and commercial expansion, moreover, and a comparatively enlightened financial system secured her internal prosperity.

The political groupings showed a Triple Alliance of England, Holland and Prussia, the members of which had little trust in each other ; and a similar grouping between Austria, France and Russia. The smaller states of Germany looked to Prussia for leadership. Denmark was under the influence of Russia, but Sweden was actually at war with her. The southern states were either under Austrian or French influence.

Declaration of Pilnitz

When Marie Antoinette began to look towards foreign intervention to stay the course of the Revolution her chief trust was placed in her brother Leopold. The Emperor was in a very strong position. He had conciliated his own subjects by wise statesmanship, had rid himself of Joseph's Turkish War by a judicious peace, and had effected an alliance with Prussia. Leopold had no wish for war with France, but he was willing to support the French Monarchy up to a point.

By the Declaration of Pilnitz (August 27, 1791) the Emperor and the King of Prussia expressed a hope that other European Monarchs would co-operate with them to secure a settlement of French affairs. When Louis accepted the Constitution of 1791 Leopold withdrew all pretension to intervene.

The Declaration of Pilnitz and the reception given to the *émigrés* were greatly resented by the French, and further friction arose over the conflicting rights of France and the Empire of Alsace. Leopold's death in 1792 removed a steadying influence. The Brissotins and Lafayette both desired war with Austria. On April 20 the French declared war, and Frederick Wilhelm of Prussia, who was alarmed by the progress of the Revolution, determined to support his Ally.

The French Army was greatly disorganised by the upheaval of the Revolution, and the loss of many of its officers ; but the artillery and the engineers (for whose officers noble blood had not been required) were excellent, and there was good fighting material in the other arms. The Allies, commanded by the old and cautious Duke of Brunswick, were repulsed in an artillery combat at Valmy on September 20, 1792. Dumouriez invaded Belgium, defeated the Austrians at Jernappes and reduced the country. Heavy requisitions and the setting up of a French Revolutionary government alienated the sympathies of the Belgians, who had at first been friendly.

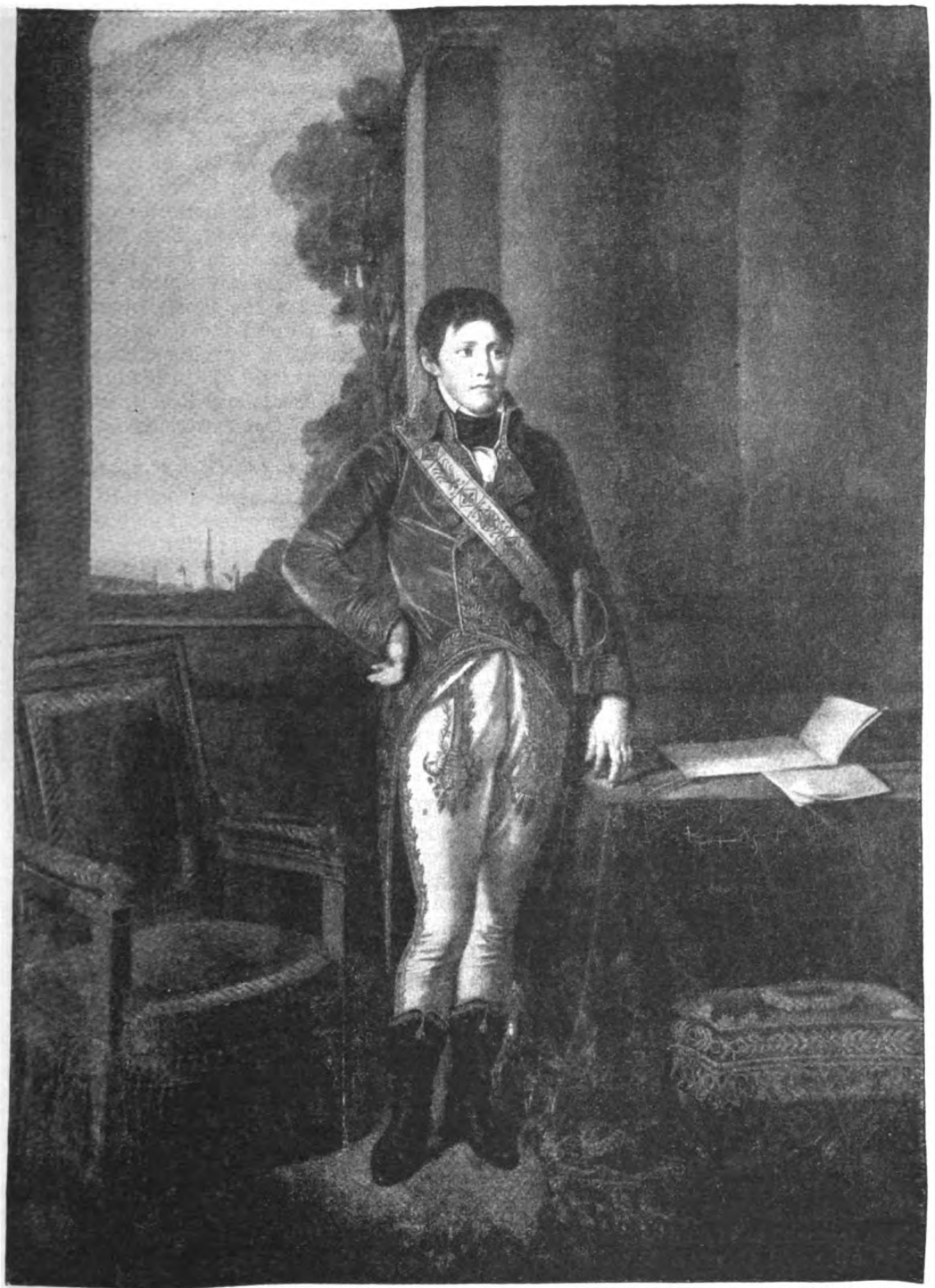
In 1793, after the execution of the King, war was declared on England, Holland and Spain. The organisation of the French Army had broken down with the collapse of the administrative machinery. Dumouriez was defeated at Neerwinden and deserted to the Austrians. The early campaigns of the year went everywhere against the French. But the energy of Danton, the awakened national feeling, and the organising genius of Carnot re-established the armies. Saint-Just and Le Bas reorganised the Army of the Rhine and placed Pichegru in command. Hoche was entrusted with the Army of the Moselle. By the end of the year Pichegru had made good the line of the Rhine, while Jourdan, in the north, defeated the Austrians at Wattignies.

Campaigns of 1794

The campaigns of 1794 were animated by Carnot. The new volunteers were brigaded with regulars to ensure steadiness. Arms were manufactured with feverish energy. Cannon were cast from church bells. The strategy was to be offensive, great forces being massed on the critical points. The tactics were to take advantage of the somewhat undisciplined enthusiasm of the troops, a cloud of skirmishers covering the advance of columns who should break the enemy's line by sheer weight.

The new spirit and the new leaders worked wonders. In June Jourdan defeated the Austrians and British at Fleurus and cleared Belgium of the Allies. Forcing the Austrians across the Meuse, he penetrated down the Rhine Valley to Coblenz and pushed the Prussians out of the Vosges. Meanwhile Pichegru invaded Holland, driving the Dutch and British before him, and by February, 1795, the whole country had submitted.

In the south, owing to divided command, the operations against the Austrians and



From the portrait by Greuze, in the Museum of Versailles.

NAPOLEON BONAPARTE IN 1791.

The earliest known portrait of the great Corsican, who was born at Ajaccio in August, 1769; he received a lieutenant's commission in the French army in 1785, and commanded the artillery during the attack on Toulon in 1793.

Sardinians were less successful, but some triumphs were obtained against Spain.

The victory of Fleurus, by relieving the pressure on the frontiers, deprived the Terror of its chief apology, and it is significant that the fall of Robespierre followed in a month's time. Moreover, the victories of 1794 had carried France to her natural boundaries. On the other hand, the prospect of an immediate restoration had passed away. The Prussian and Austrian governments, busy with designs for the partition of Poland, were profoundly suspicious of each other. On April 5, 1795, the Treaty of Basel was signed between France and Russia. On May 16 Holland also made peace, agreeing to an alliance with France against England. Peace with Spain followed on July 22, with Saxony and other minor states before the end of the year.

The war with Austria continued, but the successes won by Jourdan were thrown away owing to the treachery of Pichegru. Masséna and Augereau routed the Sardinians, and a landing of *émigrés* from English ships at Quiberon was quelled by Hoche.

Bonaparte in Italy

The Convention had now fallen and had been succeeded by the Directory, but it will be convenient to continue the narrative of the war, leaving internal affairs for later treatment.

Negotiations with Austria and England had broken down over the question of Belgium, and in 1796 a great campaign was planned in which the Army of Italy under Bonaparte was to join hands with Moreau and Jourdan from the north. Bonaparte was brilliantly successful in Italy, but the great plan fell through, owing to the energy and ability of the Archduke Charles, who left a small force to contain Moreau, and falling upon Jourdan with great violence, drove him back across the Rhine with ruinous loss. Moreau, with his communications threatened, was also compelled to retreat.

Bonaparte's career in Italy belongs to the romance of war. Any estimate of his character and abilities must be reserved. For the moment it is sufficient to say that he had attracted Carnot's attention by his handling of artillery at Toulon, his vigour on the 13 Vendémiaire, and a minute on the plan of campaign in Italy. Placed in command early in 1796, he at once acquired unbounded supremacy over the army. His opponents were feeble. The Austrian generals were old, incapable, hampered by tradition and government interference. There was little cohesion between the Allies. Napoleon fell on them like a thunderbolt, separated their armies and drove the Sardinians to ask an armistice by which they retired from the conflict. On May 16 he defeated the Austrians at Lodi; a few days later he was in Milan, received as a liberator by the people.

By clever feints he induced the Austrians to dissipate their forces, then pierced their centre and drove them into the shelter of the Alps. Dashing southwards, he occupied Leghorn, overran the Papal Legations, and drove the Pope and the King of Naples to sue for a truce. Returning to the north, he won a succession of brilliant victories, especially at Arcole and Rivoli, and early in 1797 compelled the Austrians to ask for a truce.

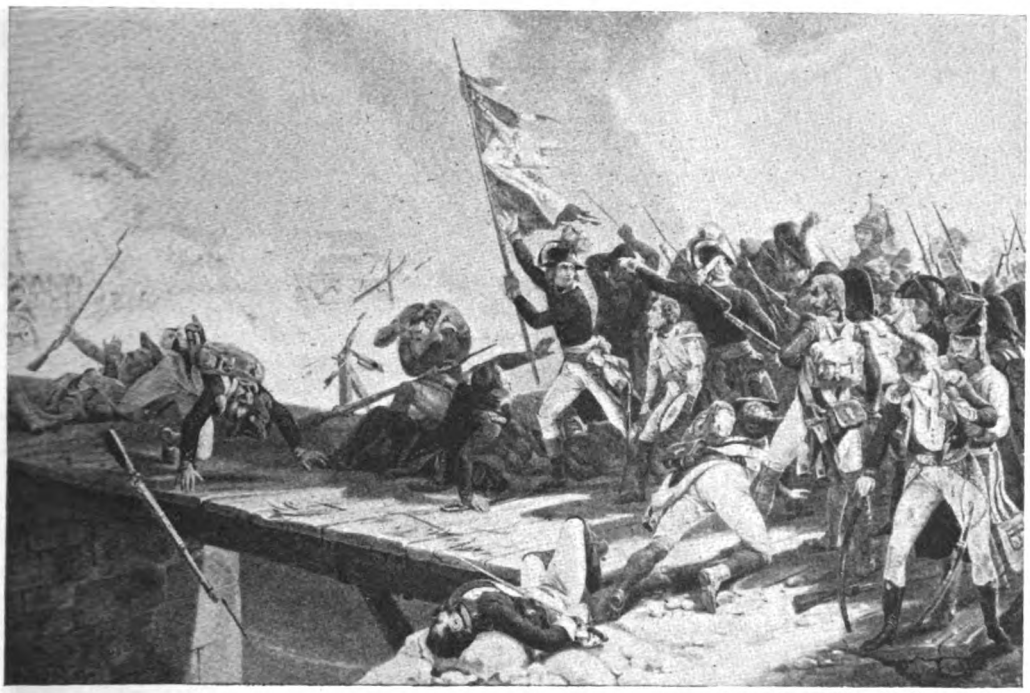
By the Preliminaries of Leoben (April 17, 1797) Austria agreed to the cession of Belgium, and recognised the French claim to the Rhine frontier; the Emperor was to renounce his claim to the Milanese but was to be allowed to acquire Dalmatia and Istria (which belonged to Venice). Milan was to become a Republic. The Cispadane Republic formed out of Romagna, Ferrara and Bologna was to be incorporated with Venice. Bonaparte, however, had no intention of considering the preliminaries as final.

Treaty of Campo-Formio

He came to a secret understanding with Austria for the partition of Venice, forced a quarrel upon the Venetian Republic, and entered the city. He then took advantage of a democratic rising in Genoa to put down the power of Genoese oligarchy. Lombardy, Modena, Reggio, Bologna, Ferrara, the Romagna, Brescia and Mantua were united into the Cisalpine Republic under French protection; Corfu was annexed to France; Genoa became the Ligurian Republic and Venice itself was abandoned to Austria.

These arrangements were embodied in the Treaty of Campo-Formio October 17, 1797.

From the military point of view Bonaparte's Italian campaigns are among the most glorious in history. Politically, there are two sides to the picture. On the one hand, the French armies undoubtedly liberated many of the Italian populations from the rule of corrupt and despotic governments and gave to the subjects of the Cisalpine Republic far better institutions than they had ever before possessed. From 1796 dates the first uprising of the Italian people and the growth of Italian nationality. On the other hand, the heavy requisitions upon



From the painting by Horace Vernet.

Bonaparte leading his men across the Bridge of Arcole—a charge which resulted in one of his series of brilliant victories in Italy in 1796.

From the picture by V. Adam.

The capitulation of Mantua—the ancient Etruscan city which, after a siege of eight months, the Austrians were forced to surrender to the all-conquering Bonaparte on Feb. 2, 1797.

the inhabitants, the immense contributions exacted from the governments who asked for peace, and the ruthless plundering of pictures, statues and manuscripts to adorn the museums in Paris marked the rise in France of a taste for conquest and spoliation. The sternness with which popular opposition was put down, and the abominable treatment of Venice, marked a breach with the generous impulses of the earlier years of the Revolution; and above all, the dictatorial power exercised by Napoleon prepared France for a military government.

The only enemy left in arms by the Peace of Campo-Formio was England. The war with England had been mainly naval, and the disorganisation caused by the Revolution had proved harder to repair in the fleet than in the army. In 1793 Hood burnt part of the Mediterranean Fleet in Toulon. In 1794 Howe defeated Villaret-Joyeuse. In 1797, Spain having joined France, a Spanish squadron was beaten by Jervis at St. Vincent, and Holland having been forced into alliance, Duncan crushed the Dutch fleet at Camperdown. Expeditions intended for the invasion of Ireland under Hoche in 1796 and under Humbert in 1798 were ruined by the British command of the sea.

France under the Directory

Before examining the causes which led to continuance of the war with England and to the formation of the second coalition we must return to a consideration of the internal affairs of France.

While the fall of Robespierre and the 13th Vendémiaire had put an end to the Terror and given again to France a regular government, it had not removed the Terrorists from power. The provision that two-thirds of the new *Corps Legislatif* should be chosen from members of the Convention enabled the latter to elect as the first Directors five regicides —La Revellière-Lépeaux, Reubell, Letourneur, Carnot and Barras. In truth, so strong a reaction had set in that it was only by clinging to power that the Conventional party could secure their own safety. The newly-elected one-third were mostly moderate men of character and reputation, representing the views of those who desired an end of the Revolutionary anarchy and a settled Republican government.

The condition of France was such that a settled government could only be expected from the wisest statesmanship. The Revolution had wrecked the administrative machinery and had replaced it only on paper. Commerce had been ruined partly by the general anarchy, partly by injudicious laws regulating prices. While a war was raging with all Europe, the finances were in a frightful condition. In December, 1789, the Assembly had made a large issue of *assignats* or mortgage bonds secured upon nationalised property. But in 1790 all interest upon the *assignats* was abolished and they became legal tender.

As the machinery of government broke down, taxes became more and more difficult to collect. Every deficit was met by a new issue of *assignats*, and the steady increase of this vast mass of paper without any backing in specie, was accompanied by an equivalent depreciation, until in January, 1795, the purchasing power of the *assignat* represented only 18 per cent. of its face value.

While the majority of Frenchmen wished for nothing but rest and orderly government, violent sections remained to trouble the peace of the nation. The irreconcilable Royalists still looked to a restoration. The extreme Jacobins would fain have revived the Terror.

Fall of Carnot

The breakdown of all authority during the Revolution, and a reaction from the gloom of the Terror, led to an incredible laxity of morals. Vice, frivolity and extravagance reigned in Paris as openly as under Louis XV.

The Directors were not the men to cope with such a situation. Carnot, the one man of genius among them, was discredited by his association with the Committee of Public Safety. Reubell was an extreme Jacobin of great ability, but brutal manners. Barras was mercenary and vicious. The other two were nonentities.

The Directory quarrelled incessantly with the *Corps Legislatif;* its government was shamelessly corrupt and its chief financial resource lay in the contributions exacted by its generals from conquered states. The Directors were committed to a war policy by the fear of losing these contributions, their increasing dependence upon the generals and their desire to avert attention from homo affairs. Hence, against the advice of Carnot they refused the offers made by Pitt in 1797.

In this year two conspiracies, one Royalist and one Communist, were detected and suppressed. The new elections for the *Corps Legislatif* gave a majority to the Moderate party and Barthelemy succeeded Letourneur as Director. Reubell, La Revellière and Barras accused the Moderates of being Royalists and obtained the support of Bonaparte, who sent Augereau to help them.

From the painting by François Bouchet, in the Louvre.

THE COUP D'ÉTAT OF (18th BRUMAIRE) 9th NOVEMBER, 1799,

when the Council of the Five Hundred were expelled by Bonaparte's Grenadiers, the Directory suppressed, and Bonaparte himself was created First Consul

On the 18th Fructidor (September 4, 1797) they effected a military *coup d'état*. Carnot, who opposed unconstitutional measures, fled the country. Barthelemy and some fifty leaders of the Constitutional party were arrested. Two extremists replaced Carnot and Barthelemy.

The Directors were now absolute rulers of France, and their rule proved fatal to the country. The government went into a state of bankruptcy by partial repudiation of the public debt. The Catholics were grossly persecuted, elections were overridden, corruption was rampant. Nor was their foreign policy any better. We have seen that the Treaty of Campo-Formio left England as the only foe of France. Bonaparte had persuaded the Directors to send him with an expedition to Egypt to cut the British communications with India. During his absence France became once more involved with a general Coalition.

Under the colour of sympathy with democratic risings, French troops invaded

Rome early in 1798, overturned the Papal Government and took the Pope prisoner. Ruthless spoliation enriched the treasury but disgusted the Italians.

In a war with Naples which followed, the French were not the aggressors, but meantime the events in Italy and Switzerland and the subsidies promised by Pitt had aroused Austria and Russia (now under Paul I.) against them. On March 5, 1799, Jourdan was defeated at Stockbach by the Archduke Charles. Suvoroff with a corps of Russians captured Séruier at Cassano and defeated Macdonald at the Trebbia. Then he turned on Masséna in Switzerland. But Austrian incapacity, selfishness and jealousy ruined the plans of the Allies. Masséna crushed a Russian corps at Zurich and Suvoroff himself only escaped with heavy loss. The Tsar, disgusted by the perversity of Austria, withdrew his troops.

We must now go back to trace the fortunes of Bonaparte. Setting sail on May 19, 1798, the expedition had the good fortune to elude Nelson, who was ill-provided with frigates. Malta was seized and Egypt was safely reached. Alexandria was captured, the Mameluke horsemen defeated in the battle of the Pyramids and the country subdued. But Nelson destroyed the French fleet in the Battle of the Nile—the most brilliant of all naval victories—and Bonaparte found himself cut off from France.

Siege of Acre

He turned northwards into Syria, stormed Jaffa with merciless slaughter (March 7, 1799) and besieged Acre. Here he was repulsed, thanks to the co-operation of an English squadron under Sir Sidney Smith. He turned back to Egypt and defeated the Turks at Aboukir. In Egypt Bonaparte learned of the situation in Europe and at once resolved to return to France.

On his return, Bonaparte found the country weary of the Directors, who had secured neither peace abroad nor good government at home. Changes in the *personnel* had made no difference to their policy; and the nation turned with eager interest to the general whose brilliant achievements had formed the one bright spot in the five years of their rule. Sieyes, who now led the moderate party, opened negotiations with him; Talleyrand, the Minister for Foreign Affairs, was of the plot. On November 9, 1799 (18th Brumaire), the insurrection broke out. The next day the Five Hundred were driven from their hall by Bonaparte's grenadiers and the Directory was suppressed.

Sieyes, the great constitution-monger, realised that the experiment of subordinating the Executive to the Legislature had broken down. The Constitution he now proposed tended to make the Executive supreme in the State. Bonaparte threw his influence into the same scale. There were to be three Consuls, a Council of State, a Senate, a Tribunate and a Legislative Body, but the provisions of the Constitution put almost all power in the hands of the First Consul, who naturally was Bonaparte himself.

Treaty of Luneville

Bonaparte turned at once against the foreign enemy. Masséna was holding Genoa stubbornly against the Austrian armies and the British Fleet. Moreau was ordered to cross the Rhine and drive back the Austrians in Southern Germany. Under cover of Moreau's success, Bonaparte entered Switzerland, crossed the Alps by the Great St. Bernard Pass and appeared in the rear of the forces besieging Genoa. On June 14 he utterly defeated them at Marengo. Moreau was reinforced; on December 3 he routed the Archduke John at Hohenlinden and pushed on almost to Vienna. Macdonald crossed the Splugen Alps from Italy and invaded the Tyrol. On February 9, 1801, the Treaty of Luneville was signed by which the Emperor recognised the Rhine frontier and the Batavian, Helvetian, Cisalpine and Ligurian Republics. Piedmont was annexed to France and Bonaparte became President of the Cisalpine Republic.

Meantime the Emperor Paul had been won over by Bonaparte, and formed, with the Scandinavian States, the Armed Neutrality which excluded English commerce from the Baltic. But Paul, who had become insane, was murdered on March 23, and on the 30th Nelson destroyed the Danish fleet at Copenhagen. The new Tsar, Alexander, agreed to a compromise with England.

Spain had remained an ally of France, and, under Bonaparte's influence, demanded that Portugal should close its ports to British trade. The Portuguese were defeated but refused to exclude British commerce.

Meantime a British Army under Abercromby had landed in Egypt. On March 19, 1801, Abercromby defeated the French whom Napoleon had left there, before Alexandria. The British general was killed but his successor drove the French to a convention by which they evacuated Egypt.

Both the English and French were weary of the long war and a Treaty was signed at Amiens in March, 1802. J. B. S-B.

Continued from Vol. V., page 459.

SCIENCES:

***Contributors*:**—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).

ELECTRICITY AND MAGNETISM.—XXV

Leyden Jars.—The capacity of the insulated charged conducting surface of a condenser is increased because of its inductive influence on the other earthed conductor. In the case of the air condenser briefly described on p. 447, Vol. V., the charged insulated plate B induces a corresponding charge of the opposite kind of electricity on the other plate A. Electricity of the same kind as that on B disappears from A since A is connected to earth. The greater the quantity of electricity you give to B, the more electricity of the opposite kind accumulates on A and holds the charge bound on B. Hence the capacity of B is greatly increased, for you can add more and more electricity to B without raising its potential rapidly. The leaves of the electroscope attached to B indicate the degree of readiness of B to part with electricity, i.e. they supply an indicator of B's potential.

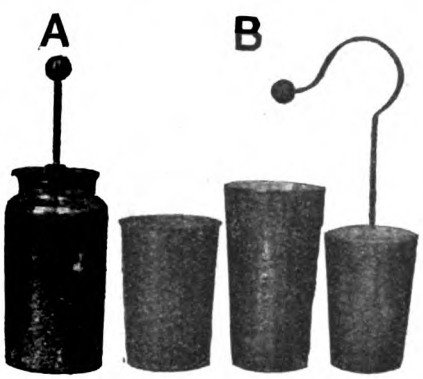


Fig. 89.—Leyden Jars: the base can be covered on both sides with tin foil, such parts of the glass as are not so covered being well varnished with shellac (as in A); or movable metal coatings may be used as conductors instead of tin foil (as in B).

In addition to the presence of an earthed conductor, other things increase the capacity of a condenser.

The larger the conducting surfaces and the nearer they are to each other the greater the capacity of the arrangement. Since the increased capacity of a condenser is based upon induction, and induction very largely depends upon the nature of the medium separating the conductors, it follows that the capacity of condensers depends upon the *specific inductive capacity* of the medium used. Thus, if glass be substituted for air in the condenser already described, the capacity of the plates will be greater than it is when air is the medium. A very simple but efficient form of condenser consists of a sheet of glass having a layer of tin foil on its upper surface and another on the under surface. These sheets of tin foil should be a little smaller than the area of the glass surface, and the lower face may be earthed by merely placing the arrangement on the table.

For practical purposes glass condensers named Leyden jars (named after Leyden, a town in Holland) are used. These consist of glass jars having an inner and an outer coating of tin foil extending about two-thirds of the way from the base towards the top. The base is covered with the foil on both sides. The parts of the glass not covered with foil are well varnished with shellac in order to make that part of the glass thoroughly non-conducting. A wooden cap fits the mouth of the jar and through this a brass rod having a knob at its upper end and a chain below forms a kind of terminal for the inner coating of tin foil which is the insulated conductor of the condenser.

Care should be exercised in handling charged Leyden jars, as a powerful shock may be experienced if a person holds the outer coating of a charged jar in one hand and touches the knob with the other. Leyden jars can be charged by the electrophorus, and they should be discharged by means of discharging tongs, a home-made variety of which consists of six inches of thick wire with rounded ends bent into a semicircle. A stick of sealing-wax attached to the middle of the semicircle will serve as a handle. To discharge a condenser touch the outer coating with one end of the wire and the knob with the other. Several Leyden jars may be con-

nected together by linking up the knobs with a piece of chain. Instead of tin foil movable metallic coatings may be employed as the conductors of a Leyden jar (Fig. 89). If such a jar is charged, the parts then separated, and the coatings discharged, when the parts are replaced another discharge can be obtained, showing that the electricity resides mainly on the glass. Moreover, one or two more faint discharges occur showing that the electricity is not all discharged at once. This is due to the fact that the glass is strained when charged, and that a little time is necessary for it to recover from this strain. The extra faint discharge is due to what is termed the *residual charge.*

With regard to the capacity and potential of the earth it is supposed that the capacity of the planet being infinite its potential is zero. No matter how much electricity you may generate by machinery and impart to the earth, its potential remains unchanged, hence the complete disappearance of electricity when charged conductors are earthed.

Many questions relating to electrification, potential and capacity are beyond the scope of our present studies, and throughout the description of electrostatic phenomena we have adhered to the simpler phraseology in the hope of avoiding lengthy discussions which would occupy too much space. The student who proceeds to more advanced work will have a clearer idea of his subject after following the simple descriptions given here.

Measurements.—A passing reference to the quantitative side of the subject will suffice.

In many ways, for instance in field and induction, static electricity is very similar to magnetism, and elementary quantitative relations are equally similar.

Thus the force of

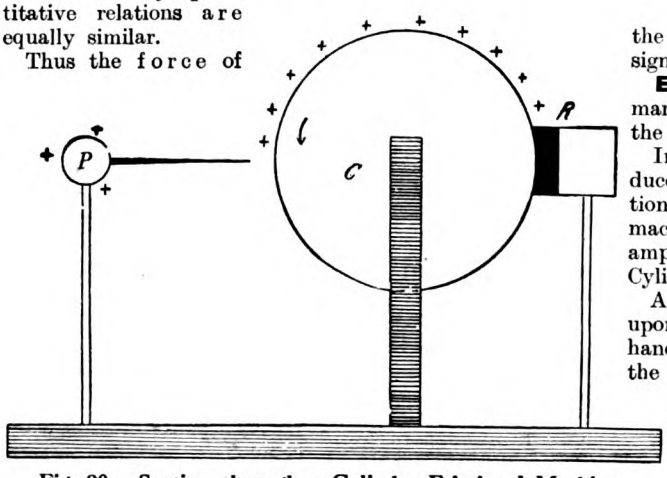


Fig. 90.—Section through a Cylinder Frictional Machine.

attraction or of repulsion between two insulated electrically charged bodies is given by the product of the two charges divided by the square of the distance. The formula expressing this statement is

$$F = \frac{Q_1 \times Q_2}{d^2},$$

in which Q_1 = measurement of the first charge in electrostatic units, Q_2 = the second charge, and d^2 = the square of the distance measured in centimetres.

The unit of electrostatic charge is that charge which repels an exactly similar charge with a force of one dyne when the distance between the two charges is one centimetre. (Compare this with magnetic measurements on pages 12, 13, Vol. III.)

Thus, if two small conductors are charged respectively with four units of positive and six units of negative electricity, and their distance apart is two centimetres, find the force of attraction between them.

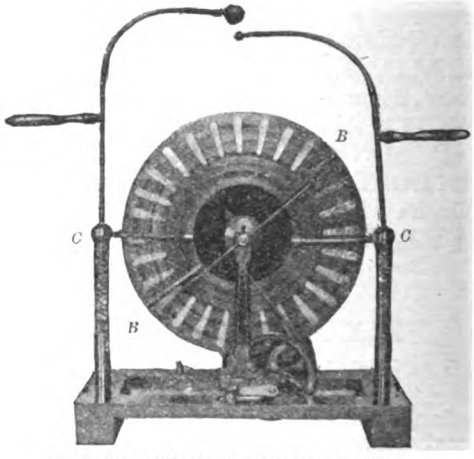


Fig. 91.—The Wimshurst Machine.

In this case

$$F = \frac{+4 \times -6}{(2)^2} = \frac{-24}{4} = -6$$

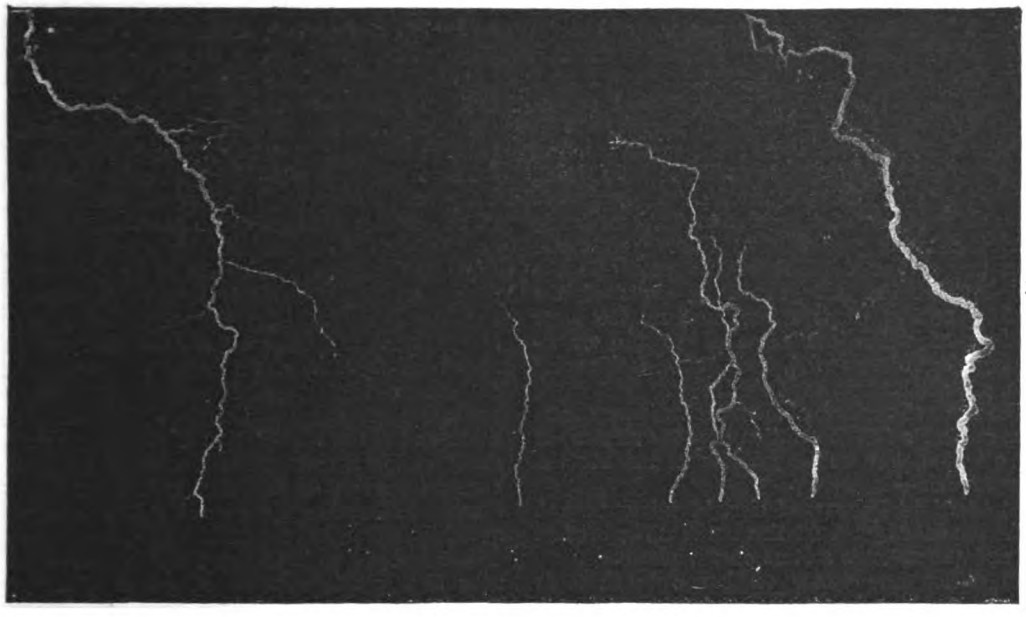
the force is 6 dynes, and the *minus* sign signifies attraction.

Electrical Machines. — There are many different types of machines used for the generation of static electricity.

In some of them the electricity is produced by friction and in others by induction. Of the two classes the induction machines are the more useful. As an example of the first class we may take the Cylinder Frictional Machine.

A horizontal glass cylinder mounted upon wooden uprights and turned by a handle is rotated so that it rubs against the rubber *R*. The latter consists of amalgamated silk, supported by an insulating glass rod. As the cylinder rotates in the direction of the arrow the friction at *R* causes the glass to be positively electrified. As the charged portions of the glass come opposite the points attached to the insulated conductor *P*, negative electricity escapes from that conductor by way of the points and neutralises the positive electricity on the glass. In this way a surplus of positive electricity accumulates on *P*. Thus the machine consists of a generating apparatus, and an accumulating arrangement, the latter (*P*) being called the prime conductor.

The simplest kind of induction machine, the electrophorus, has already been described.



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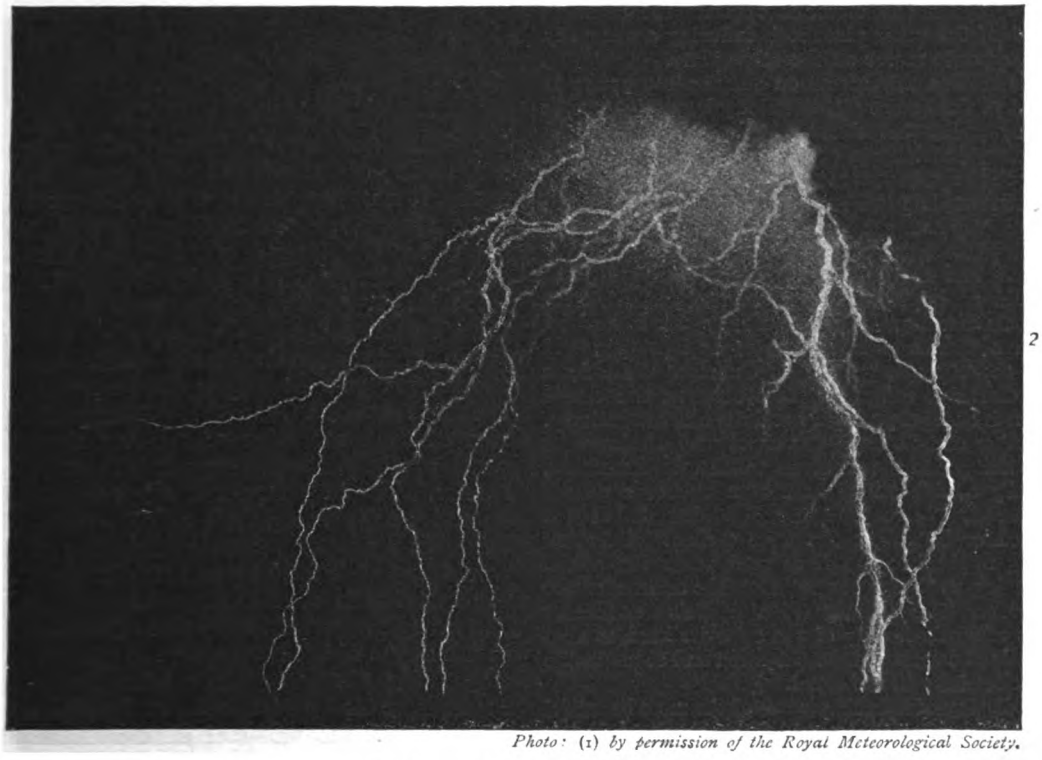

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Photo: (1) *by permission of the Royal Meteorological Society.*

LIGHTNING FLASHES.

(1) Several flashes spread over a wide area; a striking photograph taken during a storm over Sydney Harbour, Australia. (2) A series of flashes proceeding from a cloud to the earth, illustrating the continuity of the streaks which present several flashes; photographed in S. Africa

The Wimshurst Machine. — Much more complicated is the Wimshurst machine. In its simplest form it consists of two glass, or ebonite circular plates, each bearing a number of metallic strips or sectors, with their lengths arranged radially. The two plates are mounted closely together and in such a way that they rotate in opposite directions when a handle is turned. In front of each plate is a brass rod bearing two small metallic brushes (*B*). At the sides are arranged the combs (*C*) consisting of metallic conductors bearing a number of points. These points act in a way similar to that of the points in the Cylinder machine. The remaining parts of the machine consist of two Leyden jars, the inner coatings of which are attached to the comb-bearing conductors (*C*), and two discharging rods, one attached to each conductor.

The mode of working of the machine is very complex, so that a full description here is quite out of the question, but we may briefly enumerate the salient facts :—

(1) An initial charge of electricity is generated in the machine by the friction between the brushes (*B*) and the metallic sectors on the plates.

(2) When any sector touches a brush it is being charged by induction due to a charge on a sector immediately opposite on the other plate.

(3) When any sector is opposite the brush in front of the other plate it is inducing a charge in the opposite sector on the other plate.

(4) When any sector on either plate comes in front of the combs (*C*) electricity leaves the combs to neutralise the electricity on the sector, thus causing electricity to accumulate in the conductors and the Leyden jars attached.

Atmospheric Electricity.—Friction between water vapour, gas particles, and clouds in the atmosphere generates electricity on a very big scale. The air and clouds become charged, and should an opportunity present itself, clouds may become discharged, the enormous spark formed by such a discharge being known as lightning, and the accompanying noise as thunder. Sometimes the discharge may take place between two clouds if one is charged positively and the other negatively. At other times a low lying cloud may discharge its electricity into the earth, in which case something, usually a high object such as a tree or a church tower, is "struck." The lightning is always forked or branched, the term "sheet" lightning being applied to the flash seen when the actual lightning discharge occurs below the horizon of the observer. The function of a lightning conductor is to allow electricity of the opposite kind to that in a cloud to escape from the earth and so neutralise the electricity in the cloud.

A display of lightning is one of the most beautiful of nature's phenomena, and many excellent photographs of discharges have been obtained. The voltage of lightning must be an immeasurable number of millions. The reverberating nature of thunder is due to the many echoes of the original noise accompanying the electric discharge, these echoes being reflected by the clouds in various directions. Since light travels at a very much greater speed than sound, the observer usually sees the lightning several seconds before he hears the thunder. Should the lightning and thunder be perceived together, the actual discharge takes place at a short distance overhead, constituting a source of considerable danger to people and objects in the immediate vicinity. Deaths of people, cattle, etc., are usually due, not to direct discharge through the body, but to "*return shock.*"

For example, a positively charged cloud would inductively attract negative electricity to the surface of all objects on the earth near it. When the cloud discharged its electricity either to another cloud or to some object on the earth, the inducing charge would be suddenly destroyed, whereupon the negative electricity formerly bound in the person, trees and other objects would immediately rush back to earth at an incredible speed. It is the return to earth of this electricity that may produce fatal results. Our knowledge of return shock and of the distribution of electricity on conductors enables us to make one or two suggestions concerning places of least danger during a thunderstorm. Hollows in the ground, low lying ground generally, caves, and the inside of houses are among the safer places, while high ground, outdoor positions near high buildings, trees, etc., and places near large sheets of water are dangerous (*see* Vol. II., p. 270).

L. M. P.

BOTANY.—XX

55. Classification of Plants.—The great multitude of plants of different kinds makes it necessary for botanists to organise some system of classification which shall group together those forms which show a greater or less degree of natural relationship, into species, genera, orders, etc., in which these relationships are expressed. Thus a group of individuals which differ among themselves only in minor matters, e.g. in the mere size of a flower without any alteration of the proportion or relative arrangement of its parts, forms what is called a *species*. The individuals of a species would be universally recognised as all essentially alike, in spite of minor variations ; they would be fertile *inter se*, but not fertile with the individuals of another species. Dandelions vary somewhat in the size of the heads, in the shape of the leaves, and in other little ways ; but the variations are recognised to be unimportant and due to accidental conditions, and the unity of all dandelions in one species is readily understood.

But popular nomenclature is not always a safe guide. The word *buttercup*, for example, as ordinarily employed, includes more than one distinct species. These species, when we examine them, differ among themselves in well-defined and con-

stant ways—e.g. in their roots, or stems, or leaves, or again in their habits and habitats. Nevertheless they are strongly alike in their flowers. They each have a calyx, and a corolla with a nectary on each petal; many hypogynous stamens and many apocarpous carpels yielding achenes in the fruit. The species which have all these points in common in their most important organ are evidently related in some way to one another. They form a *genus*, named *Ranunculus*. Thus a genus consists of a number of species, with strongly-marked resemblances, especially in the flower and fruit. The various species are named by adding a Latin adjective or other descriptive word to the name of the genus. Thus the common meadow buttercup is *Ranunculus acris*; the spring buttercup is *Ranunculus bulbosus*; the lesser celandine is *Ranunculus ficaria*; the goldilocks is *Ranunculus auricomus* (Fig. 143).

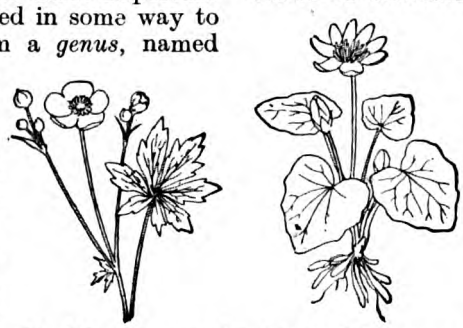


Fig. 143.—Comparative sketch of Buttercup (*Ranunculus acris*) and Celandine (*Ranunculus ficaria*) to show the differences between two species.

The various genera are again brought into larger groups, known as *natural orders*, in which the resemblances are by no means so obvious. It is in the flower, especially the gynœcium, and in the fruit, that the salient points are to be explored. As an example, compare a wood-anemone with a buttercup. No one would describe the anemone as a buttercup from any point of view; it belongs in fact to another genus, *Anemone*. But amid the differences of the flowers, we note that $A = \infty$, and the gynœcium is apocarpous and superior, as in the buttercup.

The natural orders themselves are grouped into larger classes, and these into larger divisions still. The following scheme illustrates these groupings :—

The distinctions between Dicotyledons and Monocotyledons should be carefully noticed. They are (1) the number of cotyledons in the seed; (2) the venation of the leaf, which is parallel in Monocotyledons, reticulate in Dicotyledons; (3) the vascular arrangements of the stem are quite different; (4) the perianth of Monocotyledons, when present, shows no distinction into calyx and corolla, and is *trimerous*, i.e. its parts are in threes—very rarely in fours or fives, as is the case with Dicotyledons. One or other of these points will send us into the right group of orders, and thus give a helpful start in identification.

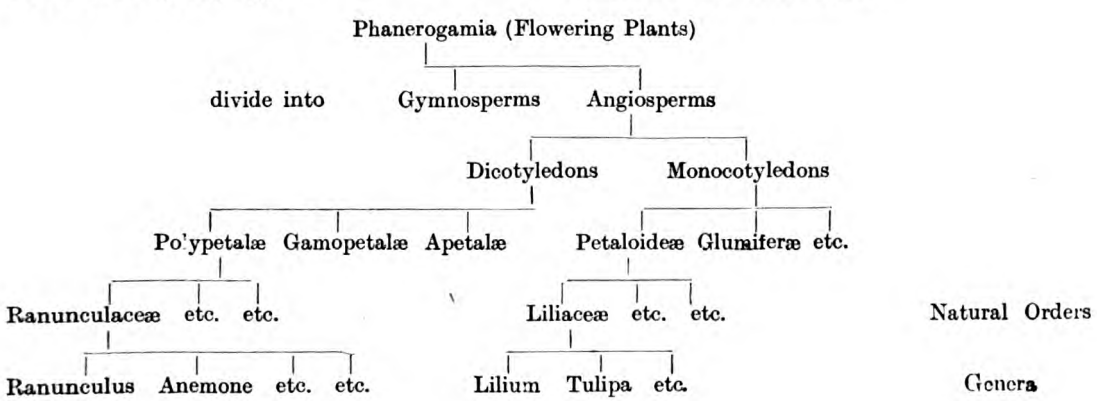
We shall now consider the more common orders of Dicotyledons, beginning with those which have polypetalous corollas. Having decided that your plant is a Dicotyledon, the next observation to make is that of the corolla.

If you find that the corolla is polypetalous, the next things to look for are the leading features of the orders next following.

DICOTYLEDONS—POLYPETALÆ.

56. Ranunculaceæ (*Buttercup family*).—The plants in this family are usually herbs, with radical or alternate leaves. Their habits vary widely, though many species are fond of damp ground or woodlands.

The corolla is sometimes absent, but then the calyx is conspicuous; the number of sepals and petals is variable. The stamens are numerous and hypogynous; the carpels apocarpous and superior. The fruits are either achenes or follicles.



The principal genera are *Ranunculus Anemone ; Caltha* (Marsh Marigold) ; *Clematis* (shrub, with opposite leaves); *Helleborus; Delphinium* (Larkspur) ; *Aconitum* (Monkshood) ; *Eranthis* (Aconite) ; *Aquilegia* (Columbine) (Figs. 144, 145, 146, 147).

There is considerable variety in the details of the flowers in this order, especially in relation to their pollination. Thus the calyx is conspicuous and the corolla absent in Anemone, Caltha and Clematis ; the flowers are open and produce an abundance of pollen. The calyx is the coloured portion in *Eranthis*, where the petals are reduced to a ring of pouch-like nectaries, as is also the case in *Helleborus*, where the calyx remains green (Fig. 146). The calyx is blue and zygomorphic in *Aconitum*, in which only two petals survive in greatly modified and reduced form ; they function as nectaries, and are concealed under the large posterior sepal, which forms the well-known hood of the flower. The bee in searching for the nectar must practically stand on the bunch of stamens and carpels. Similarly in *Delphinium*, where the nectar is in the long spur of the calyx. Here both calyx and corolla are blue ; the nectary is a spur formed from two of the petals, and corresponding to the spurred sepal in position. It is an excellent case of specialisation for the bee. *Aquilegia* has actinomorphic flowers, but each petal is spurred.

The fruits of *Caltha, Helleborus, Delphinium, Aconitum* and *Eranthis* are good examples of the follicle.

Fig. 145.—Marsh Marigold (*Caltha*).

Fig. 144.—Winter Aconite (*Eranthis*).

Fig. 147.—Monkshood (*Aconitum*).

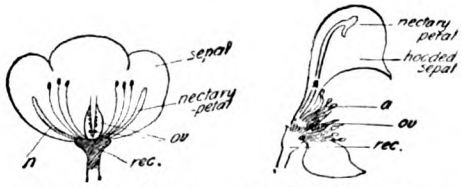


Fig. 146.—*Helleborus Viridis* and *Aconitum Napellus* : a comparative study.

Two orders not altogether dissimilar from Ranunculaceæ are :—**Nymphæaceæ** (*Waterlily family*) and **Papaveraceæ** (*Poppy family*). They have numerous hypogynous stamens and many carpels, but the latter are syncarpous. The Nymphæaceæ have many sepals and petals, and the Papaveraceæ few [generally K2, C4]. The water-lily is interesting in the multiplication of the stamens and petals, in such a way that there is a gradual transition of form, from the perfect stamen to the complete petal.

57. Cruciferæ (*Wallflower family*).—The members of this family are easily recognised by the cross-like arrangement of the four petals and by the nature of the pod, which is a siliqua or silicula. There are six stamens, of which four are longer than the other two. The floral formula is, throughout the order, K4, C4, A6, G[2]. The flowers are arranged in racemes, which are corymbose in the flower-stage but lengthen out in the fruiting period.

The Cruciferæ are herbaceous plants, with

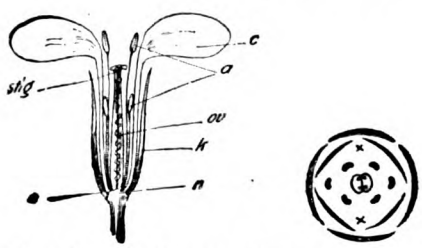


Fig. 148.—Wallflower (*Cheiranthus Cheiri*), shown diagrammatically with floral plan.

radical and alternate leaves ; the same plant will often bear both kinds, and they then differ widely in shape. Some members of the order are very small ; these may be pollinated by flies (Hedge Mustard), or self-pollinated (Shepherd's Purse). Most of the flowers are, however, comparatively deep and are pollinated by bees or moths. The honey is fairly well concealed and protected ; the insect has to insert his head between the stigma and the two outer stamens, and cross-pollination is almost certain. As many of the flowers are at least partially protandrous, it is also necessary.

There are many genera of Cruciferæ, many of them familiar plants. The following have siliquas :—*Cheiranthus* (Wallflower) (Fig. 148); *Mathiola* (Stock); *Brassica* (Turnip, Cabbage) ; *Sinapis* (Charlock) ; *Sisymbrium* (Hedge Mustard, Jack-by-the-Hedge) ; *Nasturtium* (Watercress) ; *Cardamine* (Lady's Smock) ; etc. The following have siliculas :—*Capsella* (Shepherd's Purse) ; *Alyssum ; Draba* (Vernal Whitlow-grass, common on old walls) ; *Iberis* (Candytuft) ; *Cochlearia* (Scurvy Grass). In *Raphanus* (Radish) the siliqua is jointed transversely, so that the pod breaks into a number of one-seeded divisions (*lomentum*). The flattened oval siliquas of *Lunaria* (Honesty) are characteristic and familiar.

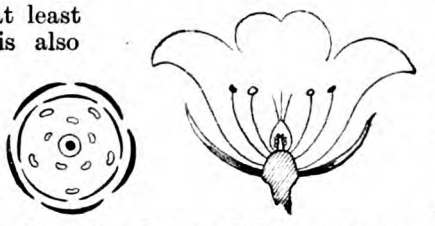


Fig. 149.—*Stellaria Holostea*, shown diagrammatically, with floral plan.

Mention may here be made of the **Fumariaceæ** (*Fumitory family*), a small order whose flowers have the formula K2, C4, A6, G[2]. They differ from the Cruciferæ especially in the corolla which is zygomorphic, and in the fruit which is a capsule with one or few seeds. The fumitory is a common little weed on chalky soil, with pink flowers, and much divided leaves.

58. Caryophyllaceæ (*Pink family*).—The characteristics of this order are almost as decisive as those of the Cruciferæ. The plants are herbs, with opposite leaves and usually with distinctly swollen nodes. The flowers are actinomorphic and arranged in dichasial cymes. The floral formula is K5, C5, A5–10, G[2–5]. The calyx is sometimes gamosepalous, forming an erect and strong support for the corolla, whose petals are clawed. The ovary is syncarpous, with free central placenta ; but the styles are free. The fruit is a capsule.

Some of the genera have very conspicuous flowers, and are pollinated by bees or butterflies. Such are :—*Lychnis* (Red Campion, White Campion, Ragged Robin, Corn Cockle) ; *Dianthus* (Pink) ; *Silene* (Bladder Campion). Other genera have small flowers and may be pollinated by flies, or self-pollinated : e.g. *Spergula* (Spurrey) ; *Arenaria* (Sandwort) ; *Cerastium* (Mouse-ear Chickweed). The genus *Stellaria* includes the greater stitchwort, with conspicuous but open flowers, as well as the smaller species, the common chickweed and the lesser stitchwort. The larger flowers are strongly protandrous, and the campions are dicœcious.

Orders of less importance to the beginner, which nevertheless include some important species, are :—

Cistaceæ (*Rock Rose family*), containing the rock rose, a common plant of bare and rocky ground ; not unlike the buttercup in the first appearance of its flower, but having a syncarpous ovary, with a three-valved capsule in its fruit (Fig. 150).

Violaceæ (*Violet family*), containing the Violet, Heartsease and Pansy (*Viola*), which have K5, C5, A5, G[3], yielding a capsule dehiscing loculicidally.

Malvaceæ (*Mallow family*), including the genera *Malva* (Mallow) and *Althæa*

Fig. 150.—Rock Rose (*Helianthemum vulgare*).

Fig. 151.—St. John's Wort (*Hypericum perforatum*).

(Marsh Mallow, Hollyhock). Floral formula K[5], C5, A ∞, G[∞]. The styles are free, but the filaments unite to form a tube around them, so that stamens and styles form a bunch in the centre of the flower. The fruit is a schizocarp, separating into a number of one-seeded capsules.

Hypericaceæ (*St. John's Wort family*), including the many species of the genus *Hypericum*. The common St. John's Wort has conspicuous star-shaped yellow flowers

and small elliptical or oblong leaves ; it is frequent in hedgerows. Its floral formula is K5, C5, A ∞, G[3]—with free styles and a valvate capsule (Fig. 151).

Geraniaceæ (*Geranium family*), containing the genera *Geranium* (Crane's Bill) ; *Erodium* (Stork's Bill) ; *Tropæolum* (Garden Nasturtium) ; *Pelargonium* (Geranium), etc. Floral formula K5, C5, A10 or 5, G[5]. Fruit a schizocarp, splitting into capsules.

E. W. E.

GEOLOGY.—VII

Classification of Exogenetic Rocks.—Exogenetic rocks owe their origin to processes at work on the earth's surface, and they are generally all grouped together under the term sedimentary. The true sedimentary rocks are, however, those formed from the deposition of detrital sediment like sands and gravels, and those formed from the accumulation of the hard parts of organisms like shell sands and coral sands. In addition to these, however, there are a few rocks, like beds of rock-salt and gypsum, which have been directly precipitated from solution. Moreover, detrital sediments are sooner or later cemented together by the precipitation between their grains of materials like calcium carbonate and silica, which are carried there in solution, after the original deposition. The term *exogenetic* has the advantage of including these, strictly speaking, non-sedimentary materials and deposits.

The exogenetic rocks may be classified in many ways, according to the special point of interest to which it is wished to call attention. Since they contain the fossil remains of past forms of life, and since the younger ones are deposited *over* the older ones, they constitute the pages in which we may read much of the earth's geological history. From this point of view they are classified stratigraphically, according to their ages. Moreover, the *structures* of the rocks, the size and roundness of their grains, the degree of alteration which their mineral fragments have suffered, and the actual minerals which they contain, go far to tell us the way in which they were deposited and the source of the material from which they have been built up. In this way much information is revealed as to the geographical conditions of former periods. According to their mode and place of deposition, the exogenetic rocks may be—

Continental—

Æolian, deposited by the wind.
Glacial, deposited by glaciers.
Fluvio-glacial, deposited by running water in glaciers.
Fluviatile, deposited by rivers.
Lacustrine, deposited in lakes.

Estuarine and deltaic, deposited in estuaries and deltas.

Marine—

Littoral, deposited between tide marks.
Shallow water, deposited on the continental shelf.
Deep sea (Terrigenous), deposited down to 1,500 fathoms.
Abyssal (Pelagic), deposited at depths below 1,500 fathoms.

The exogenetic rocks may also be classified according to their composition and origin. When the rocks of the lands are attacked by the weather, part of the material is carried away mechanically as true fragmental, clastic, or detrital sediment, part is removed in solution, and for a time part may remain. The original rock, then, is represented by residual products, detrital sediment, and salts in solution. The latter may be directly precipitated, or it may be abstracted from the waters by organisms to form their skeletons and shells, and these hard parts may again be dissolved, or, as is more general, they may accumulate on the floor of the sea. In addition there are rocks—of which coal is the chief example—which are formed from the accumulation of plant remains. We have, then, the following classification :—

1. *Residual Products.*
   (*a*) Clay.
   (*b*) Laterite.
2. *Detrital Sediments.*
   Arenaceous—
   (*a*) Pebbles, boulders, and stones—conglomerates and breccias.
   (*b*) Quartz sands—sandstones.
   Argillaceous—
   (*c*) Muds and clays—mudstone and shale
3. *Chemical Deposits.*
   (*a*) Carbonates—calcareous sinter.
   (*b*) Sulphates—gypsum.
   (*c*) Chlorides—rock-salt.
   (*d*) Silica—siliceous sinter.
4. *Organic Deposits* (formed from solution).
   (*a*) Calcareous—limestones and oozes.
   (*b*) Ferruginous—ironstones.
   (*c*) Siliceous—flints and cherts.
   (*d*) Phosphatic—phosphates.

5. *Plant and other Organic Accumulations.*
   (*a*) Coal and anthracite.
   (*b*) Petroleum, asphalt, bitumen.

The Decomposition of Rocks.— Rocks are broken down mechanically by the grinding of glaciers, the pounding of waves, the alternation of heat and cold, and of frost and thaw, the borings of animals and the roots of plants, by wind carrying a blast of sand, by rain and running water. In addition to this, water, helped enormously by carbon dioxide and oxygen dissolved from the atmosphere and by the products of vegetation and decaying organisms, is able to dissolve many of the constituents of minerals, leaving behind alteration products which are usually hydrates or carbonates. Different rocks, of course, give different products of decay, and therefore it is better to consider the alterations undergone by particular minerals. Pyroxenes and amphiboles are affected most powerfully by water bearing carbon dioxide in solution. The lime-soda felspars come next, then biotite and orthoclase, and finally muscovite and quartz, which are scarcely attacked at all. The existence of quartz accompanied by flakes of muscovite in sandstones is the best proof of the resistance which these minerals offer to chemical weathering.

From the more alterable minerals colloidal silica separates out and easily goes into solution. Soluble carbonates of sodium and potassium are formed, and also carbonates of calcium, magnesium and ferrous iron, which are soluble in water only in the presence of carbon dioxide. Ferric iron is hydrated to form limonite, $2\,Fe_2O_3$, $3\,H_2O$, which is not readily removed in solution. Thus the constituents which tend to remain and accumulate are alumina and ferric oxide, more or less hydrated. Among the accessory minerals of igneous rocks there are many—such as zircon, corundum, chromite, magnetite, and ilmenite—which successfully resist weathering and which, therefore, tend to accumulate in sands.

Since the felspars are by far the most important of igneous rock minerals, it is essential to learn what products they give rise to. For this purpose we need only consider the alkali felspars—orthoclase, $KAlSi_3O_8$ and albite, $NaAlSi_3O_8$—and the lime felspar—anorthite, $CaAl_2Si_2O_8$.

Orthoclase breaks down in three distinct ways. (1) It may lose part of its potash and silica and leave behind *sericite*, which is a secondary and hydrated form of muscovite $KH_2Al_3(SiO_4)_3$. (2) It may lose all its potash and more colloidal silica, leaving behind *kaolin*, or its colloidal form, halloysite, which are the chief of the clay minerals, $H_4Al_2Si_2O_9$. Halloysite in turn may lose all its silica and leave behind, as a final stable product, *bauxite*, which is a colloidal hydrate of alumina, the composition of which varies between $Al_2O_3.H_2O$ and $Al_2O_3.3H_2O$.

This latter change, it must be carefully remembered, is characteristic of tropical conditions, and is practically negligible in the temperate regions. (3) In the tropics orthoclase may also break down directly to gibbsite, which is a crystalline hydrate of alumina, $Al_2O_3.3H_2O$. Albite decomposes like orthoclase, except that soda-sericite is formed instead of sericite, the former being much less stable and abundant than the latter. Anorthite gives calcium carbonate, colloidal silica, and either halloysite or bauxite.

The felspars therefore break up in the following ways :—

(1) Orthoclase—sericite.
(2) Orthoclase and albite—kaolin or halloysite—bauxite.
(3) Orthoclase and albite—gibbsite.
(4) Anorthite—halloysite—bauxite.

Residual Clays and Laterites:— When from igneous and metamorphic rocks all the soluble constituents have been removed, the residual alteration products may form important masses of clay or laterite, and these, while not sedimentary, are nevertheless exogenetic. Kaolin, halloysite, or lithomarge (probably a mixture of the two former substances) form the basis of clay, the essential composition of which is a hydrated silicate of aluminium. Sericite may also be present. These deposits are found as alteration residues (wherever weathering eats down into the rock more rapidly than the transporting agents can remove the products), and particularly on granites, in which case they are accompanied by the unaltered quartz of the parent rock. Kaolin, a definite crystalline product, is thought by some geologists only to be formed as a result of the action of hot gases from igneous magmas on felspars. The china clay of Cornwall and Devon has certainly been made in this way. Kaolin may also be formed, however, by the direct action of weathering (e.g. the china clays of China, India, and Malaya), and also under bogs and moors (e.g. under the peat bogs of Ireland). Usually, the amorphous halloysite or the cryptocrystalline lithomarge is produced by ordinary weathering.

In the tropics, particularly in India and

Africa, rocks are frequently found to be covered to a considerable depth with a red residual deposit, hard and concretionary at the surface, but soft and plastic below, where it has not been exposed to the atmosphere.

This material may contain residual quartz, but it is more or less free from combined silica, and is found to be made up of bauxite, gibbsite, and limonite, together with smaller quantities of manganese and titanium oxides or hydrates. The name *laterite* is given to this peculiar product, which must be carefully distinguished from *clay*. The origin of laterite is not completely understood, but the chief factor controlling its formation lies in the more thorough leaching which rocks undergo in the tropics. In the wet season the rocks become saturated with water, and soluble materials are carried away. In the following dry season the water below the surface rises upwards by capillarity and evaporation. The originally weak solutions now become exceedingly strong, and have a powerful effect in carrying on the further decomposition of the rock to its ultimate limit. The residue thus becomes increasingly rich in hydrates of iron and aluminium, and, moreover, these materials are to some extent carried upwards—iron more than aluminium—to enrich the surface layers, in which they are deposited.

Two chief varieties of laterite may be distinguished—those rich in iron and those rich in aluminium. Naturally, there are pure laterites and pure clays; every gradation between these may occur, and, furthermore, they may be mixed with residual quartz. We have, then, the following varieties of residual deposits :—

With much quartz	*With little quartz*	*Chief minerals*
Quartzose clays	Clays	Sericite, Kaolin, Lithomarge, Halloysite
Quartzose lateritic clays	Lateritic clays	Clay minerals predominant
Quartzose argillaceous clays	Argillaceous laterites	Lateritic minerals predominant
Quartzose laterites	Laterites	Bauxite, Gibbsite, Limonite

Arenaceous Rocks.—Detrital sediments may be conveniently divided into the following types according to their grade-sizes :—

Grades	*Mineral character*
Boulders—	
More than 10 cm. in diameter	Fresh or weathered rocks.
Pebbles—	
Between 10 and 2 cm. in diam.	Do.
Gravel—	
Between 2 and 0.1 cm. in diam.	Chiefly quartz.
Sand—	
Between 0.1 and 0.01 cm. in diam.	Do.
Silt—	
Between 0.01 and 0.001 cm. in diam.	Quartz and clay.
Mud—	
Between 0.001 and 0.0001 cm. in diam.	Chiefly clay.

The term *loam* is applied to soils or sediments which contain mud or clay up to 30 or 40 per cent., in addition to sand and gravel. There is every gradation from sand through sandy loam to loam, and from loam through clay-loam to clay.

The arenaceous rocks are those in which the sandy element predominates, though the group is extended to include many coarse-grained types formed from boulders and pebbles of various compositions.

Coarse, angular fragments of pre-existing rocks are formed as screes on mountain sides, particularly in high-mountain and arctic regions. When such angular fragments are cemented together in a paste of sand or mud, or by any of the chemically precipitated cements, the resulting rock is known as a *breccia*. Breccias therefore supply valuable evidence of ancient geographical conditions, of high land subject to frost action. Other types of breccia, however, may occur. Angular ice-borne material will form a moraine breccia; along the walls of great faults and over the floors of thrust planes earth movements have sometimes crushed the adjacent rocks into breccias, known variously as crush, fault, friction, or shear breccias; as a result of volcanic explosions, another type—volcanic breccia—may be formed. Crush breccias and volcanic breccias are of endogenetic origin, being due to earth movement and igneous activity, and are only given here for completeness.

With the rounding of their fragments breccias merge into conglomerates. Rounded boulders and pebbles are characteristic of the shores of lakes, rivers and seas, and to a less extent (e.g. in boulder clay) of glacial action. Conglomerates are the cemented equivalents of these deposits, and they

generally—but not always—indicate shore conditions. Glacial conglomerates are sometimes called *tillite*. The gold-bearing banket of the Transvaal is perhaps the most important conglomerate in the world. It is made up of quartz pebbles, and is cemented with silica. Crush-conglomerates should be mentioned, formed like crush breccias but containing rounded fragments in a fine rock flour produced by rolling and grinding. They are not exogenetic, but endogenetic.

Sand is specially characteristic of shallow water and æolian deposits. It becomes rounded by rolling, but is kept angular by sliding. In running water both these movements occur, and the sand is subangular in character. Desert sands, in which rolling predominates, tend to be well rounded, but the sands of sand dunes are formed by the sea and afterwards carried by the wind, and are therefore less rounded. Glacial sands tend to be angular, except when water has played a part in carrying them and sorting them out.

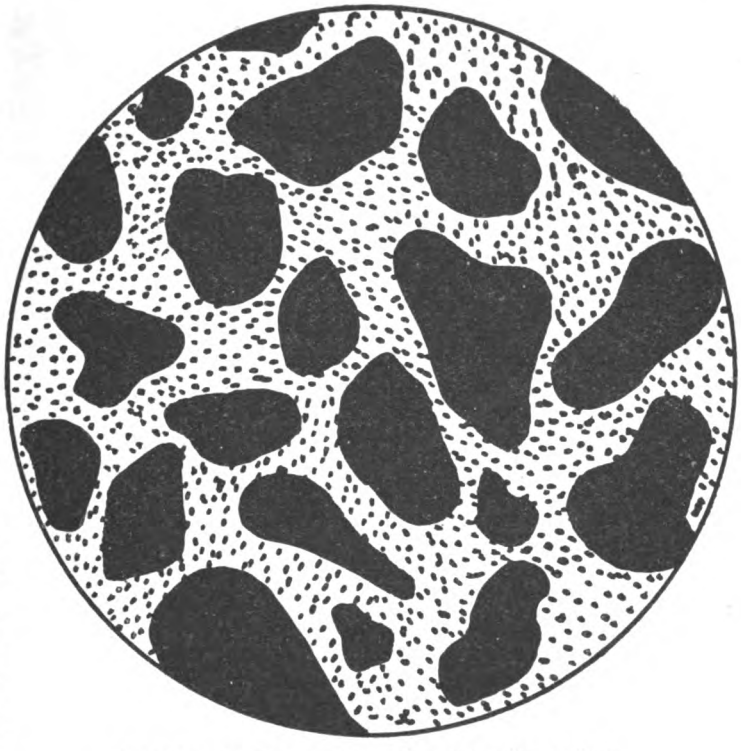


Fig. 50.—Conglomerate: a diagrammatic section.

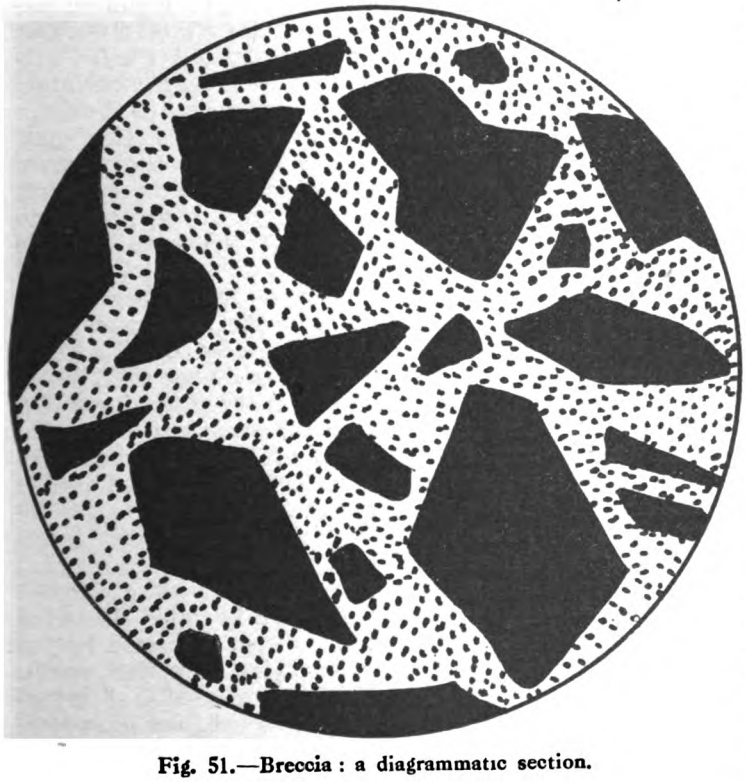


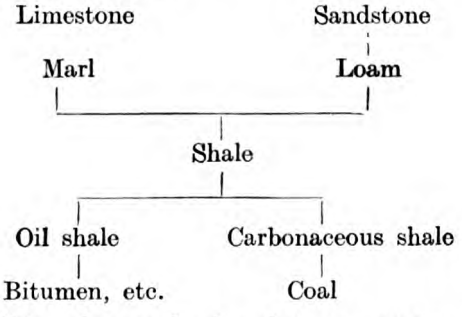
Fig. 51.—Breccia: a diagrammatic section.

Sandstones are referred to as calcareous, siliceous, or ferruginous, according to the cement which binds together the sand grains. When clay acts as a matrix an argillaceous sandstone results. According to the mineral present in addition to quartz, we may have micaceous sandstone and felspathic sandstone, or *arkose*. *Grits* are rather coarse sandstones with angular grains, and are usually cemented with silica, though not necessarily so. The term *greywacké* is applied to old grits which contain

felspathic, slaty, or volcanic fragments. When a sandstone can readily be split into thin slabs it is known as a *flagstone;* when the rock is more massive, with bedding planes widely apart, it is spoken of as *freestone.*

Sandstones frequently exhibit cross-bedding. Their fossil contents will in general indicate whether the deposit is marine, estuarine, lacustrine, or alluvial.

Argillaceous Rocks.—The clay minerals have already been enumerated. It should be noticed, however, that the plastic property, which is the most characteristic feature of clay, is due not to the mineral composition, but to smallness of grain. Muds and clays are generally coloured by impurities. Organic matter gives a black, pyrite a blue, and limonite a brown colour. By hardening under the weight of overlying deposits, mudstone without lamination, or shale with well-marked lamination, are produced. Argillaceous rocks are usually deposited quietly in moderately deep water, passing into sandy rocks on the land side, and becoming more calcareous in the seaward direction. A *marl* is a mudstone or shale containing 20 or 30 per cent. of calcium carbonate. The transitions from shales to other rocks may be shown diagrammatically as follows :—



China clays and *pipe clays* are pure and white, suitable for pottery and pipe manufacture. *Fire clays* are free from lime and alkalies, and being refractory—i.e. resisting the action of fire—they are of value in furnace building. They occur as the under clays of coal seams. *Gannister* is a highly siliceous fireclay, also occurring in the coal measures. *Fuller's earth* is a clay, used for cleansing purposes, which falls to pieces in water. When argillaceous or other very fine-grained sediments are squeezed and compressed by earth pressure they develop a cleavage inclined to the direction of the pressure, and are then called *slates.*

Glacial Clays and Loess.—The clays, silts, and sands deposited from glaciers are not so much the result of the rotting of rocks by weathering, but are essentially formed by the grinding of rocks under the ice. A glacial clay is therefore a very fine rock-flour which has suffered little chemical disintegration. *Boulder clay* or *till* is a subglacial clay crowded with angular and subangular boulders.

Loess is a fine-grained deposit of light colour having a mineralogical composition like that of glacial clays, which is found in thick beds in China and over other parts of Asia and Eastern Europe as far as the valley of the Rhine. A similar formation in the valley of the Mississippi is called adobe. The peculiar characteristics of these deposits are (1) their variety of unweathered minerals, (2) the presence of calcium carbonate, (3) the extremely fine state of division, (4) the angularity of the particles, (5) their lack of stratification, (6) their porosity, (7) their coherence. The origin of loess is a matter of dispute, and both glacial and æolian agencies have been invoked to explain it. Probably the material is a rock-flour of glacial origin, but its present distribution seems to have been controlled by the wind, aided perhaps by streams, which would help in filling up valleys and depressions. Loess is not a true clay, but is better described as a calcareous loam.

Deep Sea Muds (Terrigenous).—Most of the marine clays and muds are deposited on the continental shelf. Outside this area only the finest materials are carried. By far the commonest of the deep-sea terrigenous deposits is the *blue mud.* Its blue-grey colour is due to the presence of organic matter and of iron sulphide. The surface layer is brown or red, owing to the oxidised state of the iron. As the deposit is buried, organic matter reduces the $CaSO_4$ of sea water, iron sulphides and $CaCO_3$ being formed. The shelly remains of organisms contributes more $CaCO_3$, which may rise to as much as 30 per cent.

The *red mud* is a variety of the foregoing, but is of exceptional occurrence, occurring only off the coast of Brazil (opposite the Orinoco and Amazon Rivers), and in the Yellow Sea (opposite the Hoang Ho).

Green mud, which is found off South Africa and the Atlantic States of N. America, owes its colour to the presence of *glauconite.* This mineral, which is a hydrated silicate of potassium and ferric iron, is formed by the action of ferruginous clay on potash, partly derived from sericite or unaltered orthoclase, and partly abstracted from sea water. A similar mineral seems to be formed in

soils, and much of the potash liberated from the rocks is tied up in this way before ever reaching the oceans. Plants require potash, which they take from the soil and return to it on their decay. In addition to this terrestrial circulation of potassium, the proportion which does find its way to the sea is sooner or later fixed in the glauconitic greensands and muds, so that, unlike sodium, potassium does not tend to accumulate in the ocean waters.

Volcanic muds and sands and *coral* muds and sands require no explanation. They collect around oceanic islands, chiefly in the Pacific, and gradually merge in depth into the normal deep-sea and abyssal deposits. A. H.

ZOOLOGY.—XXXI

THE lower we go in the scale of life the more difficult it becomes to enunciate a precise classification for its multitudinous forms. Where differences are microscopical the greatest authorities are sometimes at variance. Again variations which are sufficiently pronounced to merit distinct classification in the view of one scientist may in the estimate of another be more than counterbalanced by some point of anatomical similarity. The Fleas, for instance, are to-day generally included in the *Diptera*, though this does not prevent more than one authority from classing them as a distinct order.

Insect Life

Such matters, however, except to the expert, are scarcely of vital interest. To the average mind the instinctive habits of Insects are of infinitely more interest than the reasons which suffice, or do not suffice, to secure their admission to this or that particular group. Another consideration which suggests an outline of insect life rather than an attempt at insect classification, is to be found in the fact that the class termed *Insecta* includes more than a quarter of a million known species.

The body of an insect is divided into three portions termed the head, the thorax and the abdomen. Attached to the thorax are six legs, and generally two pairs of wings, though some have only one pair, and many are altogether without them; and from the head project two *antennæ* or feelers.

If the thorax is carefully examined, it will be seen to consist of three more or less distinct parts, the relative sizes of which play an important part in the classification of species. The abdomen consists generally of nine visible rings, but in some species the number is greater and in some less. Insects are without lungs, but have in their place a wonderful network of tubes through which air is carried to all parts of the body. These *tracheæ*, as they are called, penetrate even to the tips of the wings, and preserve sufficient elasticity to remain constantly open for the free ingress of the air. The apertures by means of which the *tracheæ* communicate with the outer air occur on each side of the insect between the segments of which its body is composed.

But though all insect life is fashioned upon the same lines, prodigious differences appear in some organs of different species, and even in the organs of the same insect at different stages in its development. In the caterpillar, for instance, we find strong jaws fitted to eat leaves, but the mouth of the butterfly is provided with a long proboscis by the aid of which it sucks the nectar from flowers. The digestive organs of the caterpillar and the butterfly also, of course, show such variation as permits in the one case the assimilation of leaves, and in the other case the assimilation of honey.

Metamorphosis

But except in the lowest forms, the *Aptera*, an order including the Springtails and Fish Insects—one of which, the *Campodea*, a whitish-coloured creature about a quarter of an inch in length, common in garden mould, is thought to be the most primitive of the *Insecta*—all insects are alike in respect of the metamorphoses which they undergo before they become adult. The stages in the processes of development are clearly defined, and in the case of most species are to be clearly detected. First the egg, then the larva (the grub or caterpillar state) then the pupa (the chrysalis state) and lastly the imago (the mature completely developed insect).

An insect, therefore, does not grow, it develops. Development is continuous from the egg to the perfect insect, but there it ceases, and it is never replaced by growth. At whatever size the perfect insect has appeared, at that it remains.

Before bringing to a close this brief *résumé* of the characteristics general to insect life it is necessary to mention the strange, and to man incomprehensible, manner in which insects enjoy the sense of sight. Accustomed as we are to clear but limited vision, it is impossible for us to

appreciate the fashion in which the insect perceives the world about him. For his eyes are of two kinds. He has firstly what are termed "simple" eyes, the *ocelli*, usually three in number and placed upon the upper part of the head, and secondly he has "compound" eyes, so called because they consist of a great number of lenses, situated at the side of the head.

The difficulty of appreciating the precise effect of this dual vision lies in the fact that the image produced by one set of eyes must be entirely different from that produced by the other. The *ocelli*, it is probable, reproduce upon the mental vision of the insect a picture similar to that given by our own eyes, but the compound eyes, which in some insects have more than 20,000 facets upon each side of the head, in the prevailing opinion of entomologists, produce a picture which is mosaic in form, that is, each facet or lens reproduces its own portion of the general view. When dealing with insects, therefore, it is vastly more simple to prove by experiments that they see than to satisfy a natural curiosity as to the manner in which they do so.

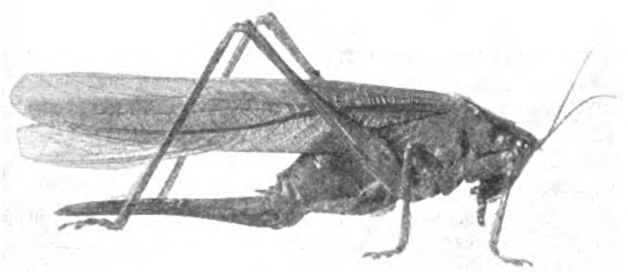


Photo: F. Martin Duncan.

GREAT GREEN GRASSHOPPER.

The chirping sound associated with grasshoppers is produced by the rapid movements of the thighs of the hinder legs on the wing cases.

The order *Orthoptera*, or Straight-Winged Insects, contains several families familiar to everyone. Earwigs, which exist in hundreds of species in all parts of the world, have as one of their chief characteristics a pair of forceps at the end of the body. The wings are deficient in a few species. The earwigs are, for the most part, of nocturnal habits, concealing themselves during the day in crevices, under a fallen tree, or under stones. Their food consists almost entirely of vegetable matter, the petals of flowers and the juices of ripe fruits offering great attraction to them. In most minds, however, this insect is primarily associated with a reputation for entering the human ear; but while it is more than probable that in isolated instances the earwig has done so, there is no evidence to support the contention that such is his general habit.

Two species are common in Britain, the Common Earwig and the *Labia Minor*, a smaller insect, chiefly found in manure heaps. The Cockroaches, like the earwigs, exist in numerous species throughout the world, being especially abundant within the tropics. Their diet consists both of animal and vegetable substances. The female of the Common Cockroach or "Blackbeetle" deposits her eggs in capsules which are oblong in form. Each capsule contains sixteen eggs. This species is said to have reached Britain originally from China, a country to which most housewives would gladly see them return.

The American Cockroach, a larger and redder species, is another member of the family who is now to be found in most European shipping ports.

Grasshoppers and Locusts constitute the family *Locustidæ*, a group in which the antennæ are short, and in which some species are practically wingless. It may be said in passing that many entomologists place the grasshopper and true locust in a separate family termed *Acridiidæ* using *Locustidæ* as the title of a group of locusts that figures far less prominently in the popular imagination. The classification adopted here, however, is that in use in the British Museum, and certainly appears the more logical.

The food of the grasshopper is exclusively of a vegetable nature, but when as sometimes occurs these insects appear in great numbers they are responsible for heavy damage. The chirping sound associated with this insect is produced by the rapid movement of the thighs of the hinder legs upon the wing cases.

The Migratory Locusts travel in vast numbers through the air in search of food and completely devastate the countryside when they settle. Specimens of this genus found in Britain probably reach this country in imported produce. The Crickets of the

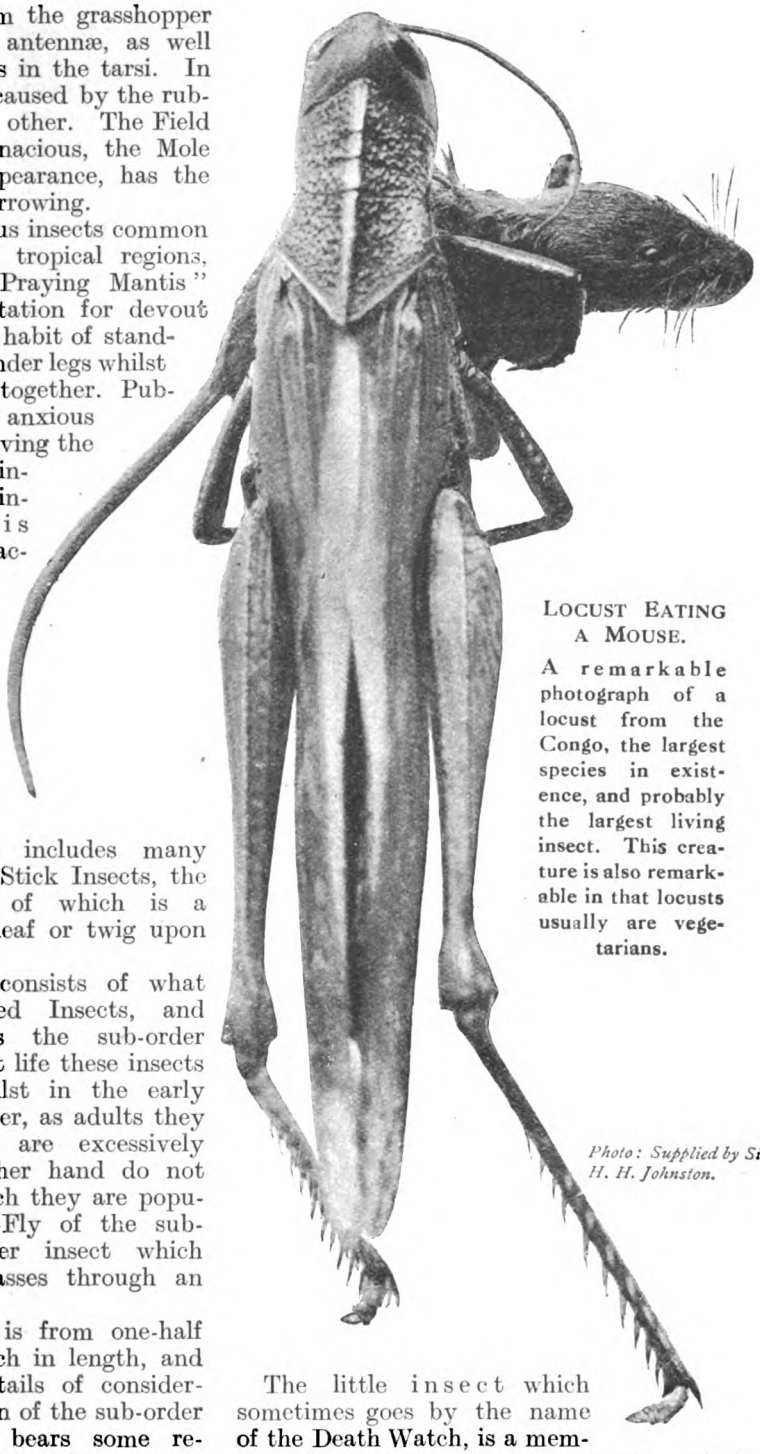
family *Gryllidæ* differ from the grasshopper in their long thread-like antennæ, as well as in the number of joints in the tarsi. In this case the chirping is caused by the rubbing of one wing upon the other. The Field Cricket is noisy and pugnacious, the Mole Cricket, of brown-like appearance, has the front legs adapted for burrowing.

The *Mantidæ*, carnivorous insects common to Southern Europe and tropical regions, include the European "Praying Mantis" which has gained a reputation for devout practices from its peculiar habit of standing upon its two pairs of hinder legs whilst holding the front pair close together. Public opinion, which is always anxious to find an excuse for believing the incredible, for long maintained that this pious insect supplemented his prayers by the very practical work of pointing out to lost travellers the road they should take. Happily since those days we have learned to doubt every story less probable than the sudden appearance of Celestial bowmen amongst repeating rifles and high calibre shells.

The family *Phasmidæ* includes many species known as Leaf or Stick Insects, the distinctive characteristic of which is a close resemblance to the leaf or twig upon which they feed.

The order *Neuroptera* consists of what are termed Nerve-Winged Insects, and contains amongst others the sub-order Dragon Flies. Throughout life these insects are carnivorous, but whilst in the early stages they live in the water, as adults they frequent the air. They are excessively voracious, but on the other hand do not possess the sting with which they are popularly credited. The May-Fly of the sub-order *Agnatha* is another insect which before becoming adult passes through an aquatic stage.

The Common May-Fly is from one-half to three-quarters of an inch in length, and carries three thread-like tails of considerable length. The Ant Lion of the sub-order *Planipennia* when adult bears some resemblance to the Dragon Fly. It gains its name, however, from its larval habits. At this stage of its career it is carnivorous, and to satisfy its appetite it digs a small pit and there awaits such ants as may fall in.



LOCUST EATING A MOUSE.

A remarkable photograph of a locust from the Congo, the largest species in existence, and probably the largest living insect. This creature is also remarkable in that locusts usually are vegetarians.

Photo: Supplied by Sir H. H. Johnston.

The little insect which sometimes goes by the name of the Death Watch, is a member of the sub-order *Cozzodentia*. It is frequently found in houses during the damp weather when its regular tap-tap may be heard in the silence of the night.

The Termites or White Ants of the sub-order *Isoptera* are amongst the most interest-

ing members of the *Neuroptera*. The nests of the White Ants, which are of great size, are in some species constructed in trees, and in others erected upon the ground, in the latter case occasionally exceeding ten feet in height. In a Termite community

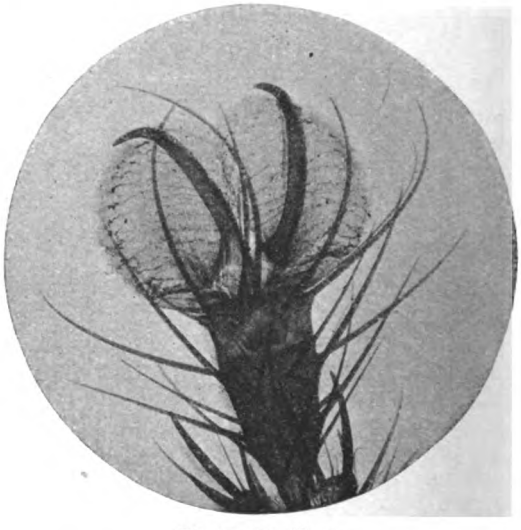
EGGS OF A HOUSE FLY
magnified twelve times.

the perpetuation of the race depends primarily upon the Queen, who inhabits a specially constructed cell which she is never destined to leave, and she ranks among the greatest wonders of the insect world, her vast egg-containing abdomen being, in some cases, two thousand times as great as the rest of her body. She is, in fact, a mere egg-producing machine capable, in favourable circumstances, of adding to the population of the nest at the rate of 3,600 per hour.

She is attended by a number of worker ants who carry her eggs to other parts of the nest where they duly develop. The colony is guarded by large-headed, strong-jawed ants termed soldiers. The Termites, in fact, greatly resemble in their habits the *Hymenoptera*, an order in the discussion of which more detailed attention will be given to some aspects of Ant Life.

The order *Diptera*, however useful it may be as a means of subsistence to other forms of life, is one that human beings would gladly sacrifice. In it we find the two-winged flies and the fleas, creatures of which it is probably correct to say that there is not one that is not either an excessive annoyance or a source of positive danger. The Common Housefly and the Blue-Bottle Fly are eminently typical of the fly. Of neither of these pests is it necessary to give a description, since both are only too well known. A word, however, may be said regarding the fly's foot. The two pyriform pads below the terminal claws are commonly supposed to act like suckers when applied to polished surfaces. This is not the case; close inspection of the pads shows that the hairs on the under surface secrete a stickiness by means of which the fly secures its footing. The egg-laying capacity of the female fly is very considerable. In the course of three weeks, during warm summer weather, one female may give rise to no fewer than one hundred or one hundred and fifty of her species.

It may be remarked, however, that a very interesting dispute has lately taken place on the extent to which the housefly hibernates during the winter. On the whole opinion inclines to the theory that it does



FOOT OF FLY
showing the pyriform pads beneath the claws.

not do so, but is sooner or later the victim of cold weather. But the point has not been conclusively settled, and in view of the disease which the Common Fly is known to spread, it may possibly become one of some importance when more attention is given to such matters.

The Tsetse Fly, common to Equatorial Africa, is now known as the medium through which Sleeping Sickness is conveyed. The dreaded Mosquito may belong to one of several species of Gnat. "Mosquito" is, in fact, the Spanish word for Gnat, and is applied somewhat indiscriminately. The Common English Gnat produces results that are sufficiently disagreeable, but which will

scarcely bear comparison with the achievements of the mosquitos of warmer climates. The female of this insect lays about three hundred eggs, which amid favourable conditions develop within four weeks. It is possible, therefore, for successive generations to multiply to an incredible extent within the course of a solitary summer.

The Horse Flies of the family *Tabanidæ* are a much dreaded group on account of the habits of the female, which attacks horses and cattle. The Horse Bot Fly lays her eggs upon the hairs of the horse within easy reach of its mouth. As the eggs develop, the horse, feeling the irritation, licks the afflicted part and so conveys the larvæ through the mouth into the stomach upon which it is parasitic.

Fleas, of which there are many different species, are members of the *Diptera* which have lost their wings from disuse. Most live upon birds or mammals. The Common

Photo: Harold Bastin.

PORTION OF A TREE TRUNK

from Brazil, hollowed out by termites, the so-called "white ants" of tropical countries.

Flea breeds in dirty houses, where the agile larvæ find an agreeable habitat in the fluffy dust which is accumulated between the floor boards. The leaping power of the flea is so marvellous as to be almost miraculous when considered in proportion to the insect's size.

The order *Rhynchota* includes a group of insects in which the mouth is modified to form a proboscis. The species of this order

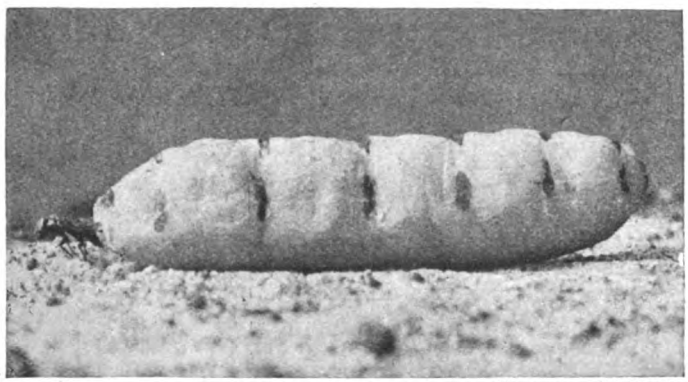


Photo: Harold Bastin.

A TERMITE QUEEN

whose egg-containing abdomen is 2,000 times as large as the rest of her body.

are very numerous, and have a world-wide distribution, though they are most plentiful, and attain their greatest size and most vivid colours, in tropical regions. The Plant Lice or Green Fly are well known to the agriculturist by reason of the damage they cause to crops.

Other species are scarcely less injurious to the orchard. The ant, however, holds the *Aphidæ* in great esteem, and frequently guards it in order to secure the juice which this minute insect secretes. By no means the least harmful of the *Aphidæ* is the Hop Aphis whose depredation in the hop-growing districts of England is largely responsible for the extent to which foreign hops are imported into this country. The Cicadas are among the most handsome groups in this order, many tropical species possessing membranous wings of beautiful colours.

The North American Cicada is reputed to be the longest lived of all the *Insecta*, its life period, as is suggested by its generic name *Cicada Septemdecim*, runs to seventeen years.

The Common House Bug feeds upon moisture drawn from pine wood, and for this reason may sometimes be found breeding behind wainscots. In Britain it is not found except in houses, but allied species frequent the nests of pigeons, swallows and bats. The Shield Bug, another variety, also feeds on plant and tree juices. A. B.

Continued from Vol. V., page 470.

LANGUAGES:

Contributors **:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A. [Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).**

GERMAN.—XXXII

Prepositions Governing the Accusative.—Gegen and wider both mean *against*. Of the two gegen is more commonly used in modern German. Wider sometimes gives the idea of more strenuous action than gegen.

Gegen has other derived meanings.

(*a*) Meaning towards, both of place and time: er blickte gen Himmel (gen is another form of gegen), *he looked towards heaven;* es war gegen zwei Uhr, *it was towards two o'clock.*

(*b*) In a metaphorical sense: die Pflicht gegen seine Mitmenschen, *duty towards one's fellow men;* er ist freundlich gesinnt gegen mich, *he is of a friendly disposition towards me;* Geld gegen einen Schein bekommen, *to get money in exchange for* (against) *a bill* (of exchange); gegen seinen Freund ist er ein Feigling, *compared with* (against) *his friend he is a coward.*

Um usually has the meaning of *round, about.*

(*a*) Of place: um die Stadt, *round the town;* um das Feuer sitzen, *to sit round the fire;* um den Garten gehen, *to walk round the garden;* um sich haben, *to have around one,* i.e. *in one's company.*

(*b*) Of time: um elf Uhr, *at eleven o'clock;* but in a vaguer sense um dieselbe Zeit, *about the same time.*

(*c*) Meaning in reference to: es handelt sich um sein Leben, *it is a question of* (with reference to) *his life;* er sagte mir wie es um die Sache stand, *he told me how it stood with reference to the matter,* i.e. *how the matter stood;* wir spielen nicht um Geld, *we do not play for money.*

(*d*) In comparisons, expressed or implied: er ist um einen halben Kopf größer als ich, *he is about half a head taller than I;* er hat sich um drei hundert geirrt, *he has made a mistake of three hundred.*

(*e*) In various idiomatic expressions: einen Tag um den andern, *every other day;* um's Leben bringen, *to deprive of life;* es ist um ihn geschehen, *it is all over with him.*

Prepositions Governing the Dative and the Accusative.—It has been explained before that in general these prepositions govern the dative when rest is indicated, and the accusative when motion towards a point is indicated. Motion within prescribed limits takes the dative. Thus, er geht in dem Garten, *he walks in the garden;* er geht in den Garten, *he walks into the garden.*

An is used to indicate contact with a thing, and is more or less equivalent to English *on* but does not mean *on the top of.*

(*a*) Of place: das Bild hängt an der Wand, *the picture hangs on the wall;* ich hänge das Bild an die Wand, *I hang the picture on the wall;* wir saßen an dem Tisch, *we sat at the table;* wir setzten uns an den Tisch, *we sat down at the table;* an einem Orte leben, *to live at a place;* am Ende sein, *to be at the end;* an das Ende gehen, *to go to the end;* Köln am Rhein, *Cologne on the Rhine* (but auf dem Wasser when we mean on top of the water); an der See, *at* (or by) *the sea;* used in conjunction with bis and followed by the accusative, bis an das Ende, *till the end.*

(*b*) In metaphorical expressions: Professor an der Universität, *Professor at the University;* es war nichts an ihm auszusetzen, *there was nothing about him to find fault with;* die Reihe war an ihm, *it was his turn;* es liegt an dir, *it rests with thee;* an seiner Stelle, *in his place;* Welle an Welle, *wave on wave:* and with the accusative: an einen schreiben, *to write to someone;* sich halten an etwas, *to cling to a thing;* es geht dir an's Leben, *thy life is at stake.*

(*c*) Of time: am ersten Mai, *on the first of May;* am vorigen Tage, *the day before;* es ist an der Zeit zu gehen, *it is time to go;* am Anfang, *at the beginning;* to express duration of time with bis and the accusative. bis an den heutigen Tag, *up to the present day.*

(*d*) To denote actual point of contact: sich am Geländer halten, *to hold by the railing:* am Kleide fassen, *to seize by the dress:* and in a metaphorical sense, an der Stimme erkennen, *to recognise by the voice.*

(*e*) With a number of verbs, to denote that to which the action is attached, or which is its cause: an etwas denken, *to think of a thing*; an einer Krankheit leiden, sterben, *to suffer from, to die of an illness*; sich an einer Sache erfreuen, *to take pleasure in a thing*.

(*f*) To denote in respect of, chiefly with certain adjectives and nouns: reich an Geld, aber arm an Freunden, *rich in money but poor in friends*; Mangel an Kräften, *lack of strength*; sie waren dreißig an der Zahl, *they were thirty in number*.

(*g*) With numerals: an die zwanzig, *about twenty*.

(*h*) Its use to form adverbial superlatives has already been explained.

(*i*) A few other miscellaneous uses are added: am Tode liegen, *to be at the point of death*; sich an der Sonne wärmen, *to warm oneself in the sun*; an die Luft setzen, *to expose to the air*.

Auf with the dative means *upon*, and with the accusative *on to*.

(*a*) Of place: auf dem Wasser schwimmen, *to float on the water*; auf den Tisch legen, *to lay upon the table*; auf dem Schloße, *at the castle*; auf dem Lande, *in the country*; auf dem Felde, *in the field*; auf der Schule, *at school*; auf der Börse, *on the exchange*; auf der Straße, *in the street*; auf die Börse gehen, *to go to the Exchange*; auf die Straße gehen, *to go into the street*.

(*b*) In metaphorical expressions: auf der Reise, *on a journey*; auf der Jagd, *hunting*; auf der Hut sein, *to be on one's guard*; auf Befehl, *by order*; ich bin auf seiner Seite, *I am on his side*, i.e. take his part; er wird darauf zurückkommen, *he will return to that*; es kommt darauf an, *it depends*; es kommt darauf an etwas zu tun, *it is of importance to do something*; auf sein Bitten, *at his request*.

(*c*) Of time, with the accusative: auf ewig, *for ever*; auf kurze Zeit, *for a short time*; auf die Minute, *punctually to the minute*; drei viertel auf zwei, *a quarter to two*; auf einmal, *suddenly*.

(*d*) Of things repeated in quick succession: Welle auf Welle, *wave on wave*; Schlag auf Schlag, *blow on blow*.

(*e*) To form various expressions of manner, with the accusative: auf diese Art, *in this way*; auf Deutsch, *in German*.

Hinter, *behind*.

(*a*) Of place: hinter der Tür stehen, *to stand behind the door*; hinter die Tür stellen, *to place behind the door*.

(*b*) In metaphorical expressions: etwas hinter sich haben, *to have got over something*; hinter eine Sache kommen, *to find out about a thing, to understand it*; hinter's Licht führen, *to deceive*.

In means *in* with the dative, and *into* with the accusative.

(*a*) Of place: im Garten gehen, *to walk in the garden*; in den Garten gehen, *to go into the garden*.

(*b*) In metaphorical expressions, of surrounding circumstances: in Angst sein, *to be in fear*; in Gefahr geraten, *to fall into danger*; im Begriff etwas zu tun, *on the point of doing a thing*; in Verlegenheit, *at a loss*; sich in eine Sache fügen, *to adapt oneself to a thing*; sich in den Finger schneiden, *to cut one's finger*; die Wüste in einen Garten verwandeln, *to change the desert into a garden*.

(*c*) Of time: in drei Wochen, *in three weeks*; ich habe sie in zwei Jahren nicht gesehen, *I have not seen her for two years*; in diesem Jahr, *this year*.

(*d*) Meaning in respect of: sich irren in einer Sache, *to make a mistake in a thing*; in solchen Fällen erfahren, *experienced in such cases*.

(*e*) In various adverbial expressions: im Ernst, *seriously*; in der Tat, *indeed*; im Gegenteil, *on the contrary*; im höchsten Grade, *in the highest degree*.

(*f*) With **bis**: bis in den Tod, *unto death*; bis in das Kleinste, *in the minutest detail*.

VOCABULARY

anfangs, *at first*.
bezeigen, w., *to show*.
Anrede, w.f., *address*.
Bischof, s.m.2., *bishop*.
entweder . . . oder, *either . . . or*.
gegenwärtig, *present*.
Stimmung, w.f., *mood*.
Gewaltthätigkeit, w.f., *violence*.
Verderben, s.n.1, *ruin*.
Vorhaben, s.n.1, *design*.
edel, *noble*.
Gerüste, s.n.1, *scaffolding*.
vergönnen, w., *to permit*, gov. dat.
rühmlich, *honourable*.
recht, *really, rightly*.
streng, *stern pitiless*.
bloß, *mere*.
Execution, w.f. *execution*.
Schrecken, s.m.1, *fright, terror*.
Lust, w.f., *desire*.
Schaffot, s.n., *scaffold*.
Volk, s.n.3, *people*.
vor'stellen, w., *to represent*.
geschehen, s., *to happen*.
gefährlich, *dangerous*.
leicht, *easily*.
Anlaß (s.m.2) geben (s.), *give rise*.
stürzen, w., *plunge*.
fahren (s.) lassen (s.), *abandon*.
Anstand, s.m.2, *decorum*.
beklagen, w., *to mourn, bewail*.
Vaterland, s.n.2, *fatherland mother-country*.
überre'den, w., *to persuade, convince*.
Verfahren, s.n.1, *proceeding*.
treiben, s., *to drive, carry*.

Exercise 71

Egmonts Tod

Egmont hatte anfangs Lust bezeigt, von dem Schaffot eine Anrede[1] an das Volk zu halten. Als ihm aber der Bischof vorstellte, daß er entweder nicht gehört werden[2], oder, wenn dies auch geschähe, bei[3] der gegenwärtigen

gefährlichen Stimmung des Volks leicht zu Gewaltthätigkeiten Anlaß geben könnte, die seine Freunde nur ins Verderben stürzen würden, so[1] ließ er dieses Vorhaben fahren. Er ging einige Augenblicke[2] lang mit edlem Anstand auf dem Gerüste auf und nieder, und beklagte, daß es ihm nicht vergönnt[3] sei, für seinen[4] König und sein Vaterland einen rühmlicheren Tod zu sterben. Bis auf den letzten Augenblick hatte er sich noch nicht recht überreden können, daß es dem Könige mit dem strengem Verfahren Ernst[5] sei, und daß man es weiter[6] als bis zum Schrecken der Execution treiben würde.

Friedrich von Schiller.

NOTES :—

(1) eine Anrede halten, *to make a speech.* (2) werden, with this we must understand könnte which occurs lower down after geben. When two verbs depend in this way on another, it is usual only to use the latter with the last of the dependent verbs. (3) bei, *in view of.* (4) Omit so. (5) einige Augenblicke lang, accusative of duration of time, for some moments; literally, some moments long. (6) vergönnt, as this verb governs a dative it cannot be used in the passive voice, except in an impersonal construction. (7) seinen König und sein Vaterland, note that though it is unnecessary to repeat the preposition für before the second noun, it is essential to repeat the possessive adjective, because the two nouns are not of the same gender. (8) ernst, es ist mir ernst mit einer Sache, is *I mean a thing seriously, I am in earnest about a thing.* (9) weiter treiben, literally, to drive further, i.e. to carry further; compare auf's äußerste treiben, *to go to extremes.*

VOCABULARY

ever, jemals.
a score, zwanzig.
white-robed, weißgekleidet.
grave, würdig.
city, Stadt, s.f.2.
story-teller, Erzähler, s.m 1.
recite, hersagen w. sep.
Arabian Nights, Tausend und eine Nacht.
tart, Torte, w.f.
fatuous, albern, abgeschmackt.
sweets, süße Speisen (w.f.).
to be past, über (gov. acc.) hinweg sein.
sot, Trunkenbold, s.m.2.
natural, natürlich.
appetite, Appetit, s.m.
corrupt, verderben, s.
strong drink, Zecherei.
raspberry, Himbeere, w.f.
disappear, verschwinden.
white-bearded, weißbärtig.
warrior, Krieger, s.m.1.
senior, Greis, w.m.
listen to, lauschen, w. gov. dat.
marvel, Wundergeschichte, w.f.
present, zugegen.
put away from one, von sich weisen, s.
rather, ziemlich.
air, Ausdruck, s.m.2.
why, warum.
kind, Art, w.f.
glutton, Schlemmer, s.m.1.
wince, zusammenfahren, s. sep.
healthy, gesund.
taste, Geschmack, s.m.2.
gluttony, Gefräßigkeit, w.f.
plateful, ein Teller (s.m. 1.) voll.
cream, Sahne, w.f.,

Exercise 72 (*continued from* 70)

Have you[1] ever seen a score of white-bearded white-robed warriors, or grave seniors of the city, seated[2] at the gate of Jaffa or Beyrout, and listening[3] to the story-teller reciting[4] his marvels out of Antar or the Arabian Nights? I was once present when a young gentleman at table put a tart away from him, and said to his neighbour, the Younger Son (with rather[5] a fatuous air), "I never eat sweets.[6]"

"Not eat[7] sweets! And do you know why?" says T.

"Because I am past that kind[8] of thing," says the young gentleman.

"Because you are a glutton and a sot!" cries the Elder (and Juvenis winces a little). "All people who have natural, healthy appetites[9] love sweets; all children, all women, all Eastern[10] people, whose tastes[11] are not corrupted by gluttony and strong drink." And a plateful[12] of raspberries and cream disappeared before the philosopher.

W. M. Thackeray.

NOTES :—

(1) *You*—use 2nd pers. plur. ihr. (2) *Seated*, say *when* (wenn) *they sit.* (3) *Listening*, say *and listen.* (4) *Reciting*, say *who recites.* (5) *Rather a*—in German the order is *a rather fatuous.* (6) *Sweets*—our translation süße Speisen really means *sweet dishes.* (7) *Not eat*—supply *you do* before *not.* (8) *That kind of thing*, Sachen der Art, i.e. things of that kind. (9) *Appetites*—use this in the singular. In German the tendency is to use the singular for single things belonging to individuals, though it is not always incorrect to use the plural. Thus we may say sie schüttelten alle den Kopf, or sie schüttelten alle die Köpfe, *they all shook their heads.* The singular is almost always preferable. (10) *Eastern*, say *of the East* (des Ostens). (11) *Tastes*—use the singular; *see* (8). (12) *Plateful*—after this word *of* should be rendered by von or else omitted altogether. The latter is the better construction.

Key to Exercise 69

Nathan.—And so, continued the judge, if you do not want my advice instead of my verdict, you had better go! But my advice is this: Accept the matter exactly as it lies. If each of you has received his ring from his father, let each believe his ring to be the true one. It is possible that your father would no longer suffer the tyranny of the one ring in his family! And it is certain that he loved you all three, and loved you equally well, in that he was unwilling to vex two in order to favour one. Well, then! Let each one strive to emulate his (the father's) pure love, free from prejudices! Let each one of you endeavour in emulation to demonstrate the power of the stone in his ring! Let each one assist this power by meekness, cordial peaceableness, benevolence, and fervent devotion to God! And when the powers of the stones are manifested in your remote descendants, then in a thousand thousand years I will summon them again before this tribunal. Then a wiser man than I will sit in this seat, and will speak. Go! Thus spoke the modest judge.

Key to Exercise 70

O Dumas! O du braver, guter, tapfrer alter Alexandre! Ich huldige dir hiermit, und danke dir für viele angenehme Stunden. Ich habe (als ich krank im Bette lag) dich während dreizehn Stunden eines glücklichen Tages gelesen, derweilen die Damen des Hauses sich um die Bände stritten. Sicherlich las der träge Bursche Dumas (oder ich will so weit gehen dem Leser zu erlauben hier das Lob seines Lieblings Schriftstellers zu singen oder dessen Namen zu nennen). Und was den Zorn oder auch die Prügel seines Schulmeisters betrifft, oder den Verweis seines Vaters, oder die zarten Bitten seiner Mutter, daß er das Abendessen nicht kalt werden lassen sollte — ich glaube nicht, daß der Taugenichts sich im geringsten darum kümmerte.

M. A. L.

GREEK.—XI

Conjugation of εἰμί, *I am.*

THE verb εἰμί, *I am*, is used not only independently but as an auxiliary verb. It is really an irregular verb of the class ending, in the first person singular present indicative, in -μι. The stem is ἐσ-, which is obviously cognate with the Latin *esse* and our *is*.

Combined with prepositions εἰμί forms a number of compounds, which are conjugated like the above, the preposition remaining invariable: Examples—πάρ-ειμι (adsum), *I am present*; ἄπ-ειμι (absum), *I am absent*; μέτ-ειμι (intersum), *I am among*; σύν-ειμι (una-sum), *I am with*; πρόσ-ειμι (in-sum), *I am near, I approach*; περί-ειμι (supersum), *I survive, I am superior*, etc.

PRESENT

		Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing.	1.	εἰμί, *I am*	ὦ, *I may be*	εἴην, *I might be*		εἶναι, *to be*	ὤν; οὖσα, ὄν, *being.*
	2.	εἶ, *thou art*	ᾖς, *thou mayst be*	εἴης, *thou mightst be*	ἴσθι, *be thou*		Gen. ὄντος,
	3.	ἐστί, *he is*	ᾖ, *he may be*	εἴη, *he might be*	ἔστω, *let him be*		ὄντος
Dual	2.	ἐστόν, *you two are*	ἦτον, *you two may be*	εἴητον εἶτον, *you two might be*	ἔστον, *be ye (two)*		
	3.	ἐστόν, *they two are*	ἦτον, *they two may be*	εἰήτην εἴτην, *they two might be*	ἔστων, *let them (two) be.*		
Plur.	1.	ἐσμέν, *we are*	ὦμεν, *we may be*	εἴημεν εἶμεν, *we might be*			
	2.	ἐστέ, *you are*	ἦτε, *you may be*	εἴητε εἶτε, *you might be*	ἔστε, *be ye.*		
	3.	εἰσί (ν), *they are*	ὦσι, *they may be*	εἴησαν εἶεν, *they might be*	ὄντων, *let them be*		

IMPERFECT

Sing.	1.	ἦν or ἦ, *I was*
	2.	ἦσθα, *thou wast*
	3.	ἦν, *he was*
Dual	2.	ἦστον or ἦτον, *you two were*
	3.	ἤστην or ἦτην, *they two were*
Plur.	1.	ἦμεν, *we were*
	2.	ἦτε, or ἦστε, *you were*
	3.	ἦσαν, *they were*

FUTURE

		Indicative.	*Optative.*	*Infinitive.*	*Participle.*
Sing.	1.	ἔσομαι, *I shall be*	ἐσοίμην, *I should be*	ἔσεσθαι, *to be about to be*	ἐσόμενος, ἐσομένη, ἐσόμενον, *about to be*
	2.	ἔσῃ or -ει, *thou will be*	ἔσοιο, *thou shouldst be*		
	3.	ἔσται, *he will be*	ἔσοιτο, *he should be*		
Dual	2.	ἔσεσθον, *you two will be*	ἔσοισθον, *ye (two) should be*		
	3.	ἔσεσθον, *they two will be*	ἐσοίσθην, *they two should be*		
Plur.	1.	ἐσόμεθα, *we will be*	ἐσοίμεθα, *we should be*		
	2.	ἔσεσθε, *you will be*	ἔσοισθε, *ye should be*		
	3.	ἔσονται, *they will be*	ἔσοιντο, *they should be*		

CONTRACTED VERBS.

Verbs ending in -αω, -εω, and -οω contract in the present and imperfect tenses according to the following rules:—

VOWEL CONTRACTIONS.

α + ε = ᾱ	ε + ε = ει	ο + ο = ου
α + η = ᾱ	ε + ει = ει	ο + ε = ου
α + ῃ = ᾳ	ε + η = η	ο + ου = ου
α + ει = ᾳ	ε + ῃ = ῃ	ο + ω = ω
α + ο = ω	ε + ο = ου	ο + η = ω
α + ω = ω	ε + ου = ου	ο + ῃ = οι
α + ου = ω	ε + ω = ω	ο + οι = οι
α + οι = ῳ	ε + οι = οι	ο + ει = οι (ου in the infin.).

In other tenses the vowel of the stem is not immediately followed by a vowel of the termination.

In these tenses τιμάω (stem τιμα), *honour*, φιλέω (stem φιλε), *love*, and μισθόω (stem μισθο), *let, hire out*, are inflected on pages 40, 41:—

VOCABULARY

ἀγαπάω, *love.*
ἀδικέω, *act unjustly, injure.*
ἀνάγκη, ἡ, *necessity*; ἀνάγκη ἐστί, *it is necessary.*
ἀπόλυσις, -εως, ἡ, *end, deliverance.*
γονεύς, -έως, ὁ, *parent, father.*
ἐράω, *love* (with gen.).
θῡμός, ὁ, *soul, spirit, temper.*
καλύπτω, *hide, conceal,*
καταλείπω, *leave, desert.*
κέρδος, -εος, τό, *gain, profit.*
κρατέω, *master, conquer* (with gen.).
Μακεδών, -όνος, ὁ, *Macedonian.*
μέλλω, *intend, be about to* (do); τὸ μέλλον, *the future, the issue.*
νικάω, *conquer.*
πολιορκέω, *besiege.*
σάρξ, -κός, ἡ, *flesh.*
σιωπάω, *be silent.*
στρατηγός, ὁ, *general.*
συμπονέω, *work with, assist.*
τάξις, -εως, ἡ, *rank, array.*
τελευτάω, *end, die.*
φοβέω, *frighten*; φοβοῦμαι, *fear.*

Exercise 11

(*a*) Translate into English:—

1. Θεὸς τοῖς ἀνθρώποις τὸ μέλλον κεκάλυφεν. 2. Οἱ στρατιῶται τὰς τάξεις κατέλιπον. 3. Οἱ ἀδικοῦντες ἀδικοῦνται αὐτοί. 4. Φοβοῦνται θάνατον, ἀπόλυσιν κακῶν. 5. Οἱ πολῖται φοβοῦνται μὴ ἡ πόλις πολιορκῆται. 6. Οἱ κακοὶ τῇ σαρκὶ δουλοῦνται.

(*b*) Translate into Greek:—

1. The boy loves his mother. 2. The general conquers all his enemies. 3. Good children love their parents. 4. They see thee. 5. Thou lovest all men. 6. Let not gain overcome thee.

ACTIVE VOICE

INDICATIVE MOOD

PRESENT

Sing.	1.	(τιμάω) τιμῶ	(φιλέω) φιλῶ	(μισθόω) μισθῶ
	2.	(τιμάεις) τιμᾷς	(φιλέεις) φιλεῖς	(μισθόεις) μισθοῖς
	3.	(τιμάει) τιμᾷ	(φιλέει) φιλεῖ	(μισθόει) μισθοῖ
Dual	2.	(τιμάετον) τιμᾶ-τον	(φιλέετον) φιλεῖτον	(μισθόετον) μισθοῦτον
	3.	(τιμάετον) τιμᾶ-τον	(φιλέετον) φιλεῖτον	(μισθόετον) μισθοῦτον
Plur.	1.	(τιμάομεν) τιμῶ-μεν	(φιλέομεν) φιλοῦμεν	(μισθόομεν) μισθοῦμεν
	2.	(τιμάετε) τιμᾶ-τε	(φιλέετε) φιλεῖ-τε	(μισθόετε) μισθοῦτε
	3.	(τιμάουσι) τιμῶσι (ν)	(φιλέουσι) φιλοῦ-σι (ν)	(μισθόουσι) μισθοῦσι (ν)

IMPERFECT

Sing.	1.	(ἐτίμαον) ἐτίμων	(ἐφίλεον) ἐφίλουν	(ἐμίσθοον) ἐμίσθουν
	2.	(ἐτίμαες) ἐτίμας	(ἐφίλεες) ἐφίλεις	(ἐμίσθοες) ἐμίσθους
	3.	(ἐτίμαε) ἐτίμα	(ἐφίλεε) ἐφίλει	(ἐμίσθοε) ἐμίσθου
Dual	2.	(ἐτιμάετον) ἐτιμᾶ-τον	(ἐφιλέετον) ἐφιλεῖ-τον	(ἐμισθόετον) ἐμισθοῦ-τον
	3.	(ἐτιμαέτην) ἐτιμά-την	(ἐφιλεέτην) ἐφιλεί-την	(ἐμισθοέτην) ἐμισθού-την
Plur.	1.	(ἐτιμάομεν) ἐτιμῶ-μεν	(ἐφιλέομεν) ἐφιλοῦ-μεν	(ἐμισθόομεν) ἐμισθοῦ-μεν
	2.	(ἐτιμάετε) ἐτιμᾶ-τε	(ἐφιλέετε) ἐφιλεῖ-τε	(ἐμισθόετε) ἐμισθοῦ-τε
	3.	(ἐτίμαον) ἐτίμων	(ἐφίλεον) ἐφίλουν	(ἐμίσθοον) ἐμίσθουν

PLUPERFECT

	ετετιμήκη	ἐπεφιλήκη	ἐμεμισθώκη

FUTURE

	τιμήσω	φιλήσω	μισθώσω

AORIST

	ετίμησα	ἐφίλησα	ἐμίσθωσα

SUBJUNCTIVE MOOD

PRESENT

Sing.	1.	(τιμάω) τιμῶ	(φιλέω) φιλῶ	(μισθόω) μισθῶ
	2.	(τιμάῃς) τιμᾷς	(φιλέῃς) φιλῇς	(μισθόῃς) μισθοῖς
	3.	(τιμάῃ) τιμᾷ	(φιλέῃ) φιλῇ	(μισθόῃ) μισθοῖ
Dual	2.	(τιμάητον) τιμᾶ-τον	(φιλέητον) φιλῆ-τον	(μισθόητον) μισθῶ-τον
	3.	(τιμάητον) τιμᾶ-τον	(φιλέητον) φιλῆ-τον	(μισθόητον) μισθῶ-τον
Plur.	1.	(τιμάωμεν) τιμῶ-μεν	(φιλέωμεν) φιλῶ-μεν	(μισθόωμεν) μισθῶ-μεν
	2.	(τιμάητε) τιμᾶ-τε	(φιλέητε) φιλῆ-τε	(μισθόητε) μισθῶ-τε
	3.	(τιμάωσι) τιμῶ-σι (ν)	(φιλέωσι (ν)) φιλῶ-σι (ν)	(μισθόωσι (ν)) μισθῶ-σι (ν)

OPTATIVE MOOD

PRESENT FORM

Sing.	1.	(τιμάοιμι) τιμῷμι	(φιλέοιμι) φιλοῖμι	(μισθόοιμι) μισθοῖ-μι
	2.	(τιμάοις) τιμῷς	(φιλέοις) φιλοῖς	(μισθόοις) μισθοῖς
	3.	(τιμάοι) τιμῷ	(φιλέοι) φιλοῖ	(τισθόοι) μισθοῖ
Dual	2.	(τιμάοιτον) τιμῷ-τον	(φιλέοιτον) φιλοῖ-τον	(μισθόοιτον) μισθοῖ-τον
	3.	(τιμαοίτην) τιμῴ-την	(φιλεοίτην) φιλοί-την	(μισθοοί-την) μισθοί-την
Plur.	1.	(τιμάοιμεν) τιμῷ-μεν	(φιλέοιμεν) φιλοῖ-μεν	(μισθόοιμεν) μισθοῖ-μεν
	2.	(τιμάοιτε) τιμῷ-τε	(φιλέοιτε) φιλοῖ-τε	(μισθόοιτε) μισθοῖ-τε
	3.	(τιμάοιεν) τιμῷεν	(φιλέοιεν) φιλοῖ-εν	(μισθόοιεν) μισθοῖεν

ATTIC FORM

Sing.	1.	(τιμαοίην) τιμῴ-ην	(φιλεοίμην) φιλοί-ην	(μισθοοίην) μισθοίην
	2.	(τιμαοίης) τιμῴ-ης	(φιλεοίης) φιλοί-ης	(μισθοοίης) μισθοί-ης
	3.	(τιμαοίη) τιμῴ-η	(φιλεοίη) φιλοί-η	(μισθοοίη) μισθοί-η
Dual	1.	(τιμαοίητον) τιμῴ-ητον	(φιλεοίητον) φιλοί-ητον	(μισθοοίητον) μισθοί-ητον
	2.	(τιμαοιήτην) τιμῳ-ήτην	(φιλεοιήτην) φιλοι-ήτην	(μισθοοιήτην) μισθοι-ήτην
Plur.	1.	(τιμαοίημεν) τιμῴ-ημεν	(φιλεοίημεν) φιλοί-ημεν	(μισθοοίημεν) μισθοί-ημεν
	2.	(τιμαοίητε) τιμῴ-ητε	(φιλεοίητε) φιλοί-ητε	(μισθοοίητε) μισθοί-ητε
	3.	(τιμάοιεν) τιμῷεν	(φιλέοιεν) φιλοῖ-εν	(μισθόοιεν) μισθοῖεν

IMPERATIVE MOOD PRESENT TENSE

Sing.	2.	(τίμαε) τίμα	(φίλεε) φίλει	(μίσθοε) μίσθου
	3.	(τιμαέτω) τιμά-τω	(φιλεέτω) φιλεί-τω	(μισθοέτω) μισθού-τω
Dual	2.	(τιμάετον) τιμᾶ-τον	(φιλέετον) φιλεῖ-τον	(μισθόετον) μισθοῦ-τον
	3.	(τιμαέτων) τιμά-των	(φιλεέτων) φιλεί-των	(μισθοέτων) μισθού-των
Plur.	2.	(τιμάετε) τιμᾶτε	(φιλέετε) φιλεῖ-τε	(μισθόετε) μισθοῦ-τε
	3.	(τιμαέτωσαν) τιμάτωσαν	(φιλεέτωσαν) φιλεί-τωσαν	(μισθοέτωσαν) μισθού-τωσαν
		(or τιμαόντων) τιμώντων	(φιλεόντων) φιλοί-ντων	(μισθοόντων) μισθούντων

INFINITIVE MOOD PRESENT TENSE

	(τιμάειν) τιμᾶν	(φιλέειν) φιλεῖν	(μισθόειν) μισθοῦν

PARTICIPLES

(τιμάων) τιμῶν	(φιλέων) φιλῶν	(μισθόων) μισθῶν
(τιμάουσα) τιμῶσα	(φιλέουσα) φιλοῦσα	(μισθόουσα) μισθοῦ-σα
(τιμάον) τιμῶν	(φιλέον) φιλοῦν	(μισθόον) μισθοῦν
(τιμαόντος) τιμῶντος	(φιλέοντος) φιλοῦ-ντος	(μισθόοντος) μισθοῦ-ντος
(τιμαούσης) τιμώσης	(φιλεούσης) φιλού-σης	(μισθοούσης) μισθοῦ-σης

MIDDLE AND PASSIVE

Indicative Mood

Present

Sing.	1.	(τιμάομαι) τιμῶ-μαι	(φιλέομαι) φιλοῦμαι	(μισθόομαι) μισθοῦ-μαι
	2.	(τιμάῃ, τιμάει) τιμᾷ	(φιλέ-ῃ) (φιλέε) φιλῇ, φιλεῖ	(μισθόῃ, μισθόει) μισθοῖ
	3.	(τιμάεται) τιμᾶ-ται	(φιλέεται) φιλεῖται	(μισθόεται) μισθοῦ-ται
Dual	2.	(τιμάεσθον) τιμᾶ-σθον	(φιλέεσθον) φιλεῖ-σθον	(μισθόεσθον) μισθοῦ-σθον
	3.	(τιμάεσθον) τιμᾶ-σθον	(φιλέεσθον) φιλεῖ-σθον	(μισθόεσθον) μισθοῦ-σθον
Plur.	1.	(τιμαόμεθα) τιμώ-μεθα	(φιλεόμεθα) φιλού-μεθα	(μισθοόμεθα) μισθού-μεθα
	2.	(τιμάεσθε) τιμᾶ-σθε	(φιλέεσθε) φιλεῖ-σθε	(μισθόεσθε) μισθοῦσθε
	3.	(τιμάονται) τιμῶνται	(φιλέονται) φιλοῦ-νται	(μισθόονται) μισθοῦνται

Imperfect

Sing.	1.	(ἐτιμαόμην) ἐτιμώμην	(ἐφιλεόμην) ἐφιλού-μην	(ἐμισθοόμην ἐμισθούμην
	2.	(ἐτιμάου) ἐτιμῶ	(ἐφιλέου) ἐφιλοῦ	(ἐμισθόου) ἐμισθοῦ
	3.	(ἐτιμάετο) ἐτιμᾶ-το	(ἐφιλέετο) ἐφιλεῖ-το	(ἐμισθόετο) ἐμισθοῦ-το
Dual	2.	(ἐτιμάεσθον) ἐτιμᾶ-σθον	(ἐφιλέεσθον) ἐφιλεῖ-σθον	(ἐμισθόεσθον) ἐμισθοῦ-σθον
	3.	(ἐτιμαέσθην) ἐτιμά-σθην	(ἐφιλεέσθην) ἐφιλεί-σθην	(ἐμισθοέσθην) ἐμισθούσθην
Plur.	1.	(ἐτιμαόμεθα) ἐτιμώ-μεθα	(ἐφιλεόμεθα) ἐφιλού-μεθα	(ἐμισθοόμεθα) ἐμισθού-μεθα
	2.	(ἐτιμάεσθε) ἐτιμᾶ-σθε	(ἐφιλέεσθε) ἐφιλεῖ-σθε	(ἐμισθόεσθε) ἐμισθοῦ-σθε
	3.	(ἐτιμάοντο) ἐτιμῶντο	(ἐφιλέοντο) ἐφιλοῦ-ντο	(ἐμισθόοντο) ἐμισθοῦντο

Subjunctive Mood

Sing.	1.	(τιμάωμαι) τιμῶμαι	(φιλέωμαι) φιλῶ-μαι	(μισθόωμαι) μισθῶμαι
	2.	(τιμάῃ) τιμᾷ	(φιλέῃ) φιλῇ	(μισθόῃ) μισθοῖ
	3.	(τιμάηται) τιμᾶ-ται	(φιλέηται) φιλῆ-ται	(μισθόηται) μισθῶ-ται
Dual	2.	(τιμάησθον) τιμᾶ-σθον	(φιλέησθον) φιλῆ-σθον	(μισθόησθον) μισθῶ-σθον
	3.	(τιμάησθον) τιμᾶ-σθον	(φιλέησθον) φιλῆ-σθον	(μισθόησθον μισθῶ-σθον
Plur.	1.	(τιμα-ώμεθα) τιμώ-μεθα	(φιλεώμεθα) φιλώ-μεθα	(μισθοώμεθα) μισθώμεθα
	2.	(τιμάησθε) τιμᾶ-σθε	(φιλέησθε) φιλῆ-σθε	(μισθόησθε) μισθῶσθε
	3.	(τιμάωνται) τιμῶνται	(φιλέωνται) φιλῶ-νται	(μισθόωνται) μισθῶνται

Optative Mood

Present

Sing.	1.	τιμαοίμην τιμῴ-μην	φιλεοίμην φιλοί-μην	μισθοοίμην μισθῷμην
	2.	τιμάοιο τιμῷ-ο	φιλέοιο φιλοῖ-ο	μισθόοιο μισθοῖ-ο
	3.	τιμάοιτο τιμῷ-το	φιλέοιτο φιλοῖ-το	μισθόοιτο μισθοῖ-το
Dual	2.	τιμάοισθον τιμῷ-σθον	φιλέοισθον φιλοῖ-σθον	μισθόοισθον μισθοῖ-σθον
	3.	τιμαοίσθην τιμῴ-σθην	φιλεοίσθην φιλοί-σθην	μισθοοίσθην μισθοί-σθην
Plur.	1.	τιμαοίμεθα τιμῴ-μεθα	φιλεοίμεθα φιλοί-μεθα	μισθοοίμεθα μισθοί-μεθα
	2.	τιμάοισθε τιμῷ-σθε	φιλέοισθε φιλοῖ-σθε	μισθόοισθε μισθοῖ-σθε
	3.	τιμάοιντο τιμῷ-ντο	φιλέοιντο φιλοῖ-ντο	μισθόοιντο μισθοῖντο

Imperative Mood

Sing.	2.	(τιμάο) τιμῶ	(φιλέου) φιλοῦ	(μισθόου) μισθοῦ
	3.	(τιμαέσθω) τιμάσθω	(φιλέεσθω) φιλεί-σθω	(μισθοέσθω) μισθού-σθω
Dual	2.	(τιμάεσθον) τιμᾶσθον	(φιλέεσθον) φιλεί-σθω	(μισθόεσθον) μισθοῦ-σθον
	3.	(τιμαέσθων) τιμάσθων	(φιλεέσθων) φιλεί-σθων	(μισθοέσθων) μισθού-σθων
Plur.	2.	(τιμάεσθε) τιμᾶσθε	(φιλέεσθε) φιλεῖ-σθε	(μισθόεσθε) μισθοῦ-σθε
	3.	(τιμαέσθωσαν) τιμάσθωσαν	(φιλεέσθωσαν) φιλεί-σθωσαν or (φιλεέσθων) φιλεί-σθων	(μισθοέσθωσαν) μισθοί-σθωσαν (μισθοέσθων) μισθού-σθων

Infinitive Mood

(τιμάεσθαι) τιμᾶσθαι	(φιλέεσθαι) φιλεῖ-σθαι	(μισθόεσθαι) μισθοῦ-σθαι

Present Participle

τιμαόμενος τιμώ-μενος	φιλεόμενος φιλού-μενος	μισθοόμενος μισθού-μενος
τιμαομένη τιμω-μένη	φιλεομένη φιλου-μένη	μισθοομένη μισθου-μένη
τιμαόμενον τιμώ-μενον	φιλεόμενον φιλού-μενον	μισθοόμενον μισθού-μενον
τιμαομένου τιμω-μένου	φιλεομένου φιλου-μένου	μισθοομένου μισθου-μένου
τιμαομένης τιμω-μένης	φιλεομένης φιλου-μένης	μισθοομένης μισθου-μένης

Perfect

τετίμημαι	πεφίλημαι	μεμίσθωμαι

Pluperfect

ἐτετιμήμην	ἐπεφιλήμην	εμεμισθώμην

Future Middle

τιμήσομαι	φιλήσομαι	μισθώσομαι

Aorist Middle

ἐτιμησάμην	ἐφιλησάμην	ἐμισθωσάμην

Future-Perfect

τετιμήσομαι	πεφιλήσομαι	μεμισθώσομαι

Aorist Passive

ετιμήθην	εφιλήθην	ἐμισθώθην

Future Passive

τιμηθήσομαι	φιληθήσομαι	μισθωθήσομαι

E. A. B.

RUSSIAN.—XXIV

The Conjunctions

233. A CONJUNCTION is a word or part of speech which connects words, clauses, and sentences.

They may be of two kinds, co-ordinate and subordinate. The former join co-ordinate clauses in compound sentences, the latter join subordinate sentences.

The principal simple conjunctions are :

а, *and, but.*	ра́звѣ, *unless.*
да, *and, but, may.*	столь, *so.*
да́же, *even.*	та́кже, *also, too.*
дабы́, *in order to.*	то́же, *also, too.*
е́сли, *if, in case.*	такъ, *so.*
е́жели, *if, in case.*	то́лько, *only.*
и, *and, also, even.*	хотя́, *although, though, though even.*
и́бо, *for, because.*	хоть, *at least.*
и́ли, *or.*	что, *that.*
какъ, *as, like, how.*	что́бы, *to, that, in order to.*
но, *but.*	чѣмъ, *than.*
не́жели, *than.*	
одна́ко, *but, however, yet, nevertheless.*	

234. The conjunctions, whether simple or compound, and whether original or formed from other parts of speech, such as Adverbs and Pronouns, serve either to connect parts of single sentences or whole sentences.

235. In the latter case, the conjunctions are preceded by commas.

Examples

Э́то дёшево, а то до́рого,	*This is cheap, and that is dear.*
Э́то не серебро́, а аргента́нъ,	*This is not silver, but argentine.*
Мнѣ ну́женъ чай да са́харъ,	*I require tea and sugar.*
Да э́то непра́вда,	*But this is an untruth.*
Да здра́вствуетъ свобо́да!	*Long live freedom!*
Я такъ поступа́ю, и́бо э́то необходи́мо,	*I act so, because it is necessary.*
Скажи́те да и́ли нѣтъ,	*Say yes or no.*
Я всё сдѣлалъ, какъ Вы проси́ли,	*I have done all, as you asked.*
Дѣло грома́дное, но успѣхъ сомни́теленъ,	*The business is big, but the success is doubtful.*
Я не закажу́, ра́звѣ усту́пите,	*I shall not order, unless you reduce the price.*
Оно́ такъ лу́чше,	*It is better so.*
Бу́дьте му́жественны, хотя́ опа́сность велика́,	*Be courageous, although the danger is great.*
Уступи́те хоть оди́нъ проце́нтъ,	*Allow at least one per cent.*
Я зналъ, что Вы согласи́тесь,	*I knew that you would give in.*
Лу́чше не про́дамъ, чѣмъ потеря́ть на това́рѣ,	*I had better not sell than lose on the goods.*

236. The principal compound conjunctions are :—

Бу́дто, бу́дто-бы, какъ бу́дто,	*as if.*
Для того́ что́бы,	*in order to.*
Е́сли то́лько,	*if only.*
Какъ то́лько, лишь то́лько,	*as soon as.*
Или-и́ли,	*either, or.*
Ита́къ,	*so then, thus.*
Какъ-бы,	*as if.*
какъ ни,	*however much.*
какъ нибу́дь, какъ-то,	*somehow, anyway.*
какъ-то,	*viz., namely.*
ме́жду тѣмъ какъ,	*whereas, while.*
не то́лько -но и,	*not only, but also.*
неу́жели ?	*is it a fact, really ?*
ни—ни,	*neither—nor.*
отто́го что,	*for the reason that.*
потому́ что,	*because.*
по́слѣ того́—какъ,	*after.*
пре́жде—чѣмъ,	*before.*
пока́,	*while, so long as.*
ра́ньше—чѣмъ,	*before.*
такъ какъ,	*whereas, as, seeing that.*
такъ что ; такъ что́бы,	*so that.*
всё таки́ ; тѣмъ не ме́нѣе,	*nevertheless, none the less.*
тогда́ какъ,	*whereas, while.*
чѣмъ бы,	*instead of.*

Examples

Онъ бу́дто не понима́етъ,	*As if he did not understand.*
Онъ и́ли дура́къ, и́ли невѣ́жа,	*He is either a fool, or an ignorant fellow.*
Онъ ни то, ни друго́е,	*He is neither this nor that.*
Ита́къ, Вы ре́шили уѣхать,	*So then you have decided to go.*
Тамъ всё споко́йно, какъ-бы ничего́ не случи́лось,	*All is quiet there, as if nothing had happened.*
Какъ ни стара́юсь, всё напра́сно,	*However much I try, it is all in vain.*
Мы какъ нибу́дь существу́емъ,	*We are existing somehow.*
Дѣло какъ-то не кле́ится,	*The thing does not meet with success, somehow.*
Это не то́лько вре́дно, но и опа́сно,	*It is not only harmful but dangerous too.*
Неу́жели не понима́ете ?	*Do you not really understand ?*

237. To the conjunctions belong the particles ли, бы, же and то. These are only used in conjunction with some other parts of speech.

Examples

Здоро́вы ли Вы ?	*Are you in good health ?*
Ва́ше ли э́то ?	*Is this yours ?*
Вы бы меня́ спроси́ли,	*You would ask me.*
Я бы не согласи́лся,	*I would not agree.*
Гдѣ же Вашъ магази́нъ ?	*Where is your shop, then ?*
Это же мой магази́нъ,	*Well, this is my shop.*
Кто-то Васъ спра́шиваетъ,	*Somebody is asking for you.*
Я Васъ гдѣ-то ви́дѣлъ,	*I have seen you somewhere.*

The Interjections

238. An interjection is a part of speech which expresses sudden emotion, excitement or feeling, as shown in the examples below.

The principal interjections are :—

For expressing surprise—

а! *ah! well!* ахъ! *oh*

For expressing laughter—

ха, ха! *ha, ha!*

For expressing pain, fear, grief—

ой! *oh! ah!* áхти! *alas! ah!*

For expressing joy—

урá! *hurrah!*

For expressing contempt, aversion—

э! *eh!* эхъ! *ah!*

тьфу! *fi! pshaw!*

For expressing pain, sorrow—

ахъ! *ah!* о! *oh!*

ай! *ah!* гóре! *woe! alas!*

охъ! *oh! ah! oy!* увы́! *alas! oh! woe!*

For expressing menace—

тсъ! *sh!* цыцъ! *hush!*

For expressing encouragement, exhortation—

ну! *now! well! come on!* ну́же! *come on!*

For calling somebody—

эй! *hey! hallo!* гей! *hey! hallo*

Orthography

239. The letter "і" is written only before a vowel or before "й." It must never be written before a consonant except in the word міръ, *the world*, to distinguish it from the word миръ, *peace*.

240. The letter "ь" cannot come after the consonants г, к, х, ц.

241. The letter "ы" must not appear after ж, ч, ш, щ, г, к, х. It is replaced by "и."

242. The vowels "ю," "я," cannot appear after ж, ч, ш, щ, г, к, х, and they are replaced in such cases by "у," "а," respectively.

243. The vowel "ѣ" cannot appear in the middle of a word after the letters г, к, х, ж, ч, ш, щ, and therefore "е" is written instead.

244. The words кѣмъ, чѣмъ (*by whom; by what, whereby*) are exceptions to the above rule.

245. The following is a list of the principal words in which the sound *ye* is transmitted by the letter "ѣ."

After б:

Бѣгать, бѣжáть,	*to run.*
Бѣдá,	*trouble, calamity.*
Бѣдность,	*poverty.*
Бѣдствіе,	*misfortune, distress.*
Побѣда,	*victory.*
Побѣди́ть,	*to vanquish.*
Убѣди́ть,	*to persuade, convince.*
Убѣжде́ніе,	*persuasion, conviction.*
Бѣлый,	*white.*
Бѣлѣть,	*to become white.*
Бѣли́ть,	*to bleach.*
Бѣльё,	*linen, underclothing.*
Обѣщáть,	*to promise.*
Обѣщáніе,	*promise.*

After в:

Вѣдать,	*to know, have cognisance, superintend.*
Завѣдывать чѣмъ,	*to administer, direct, manage.*
Завѣдывающій,	*manager, superintendent.*
Довѣдаться,	*to get to know.*
Свѣдѣніе,	*information, cognisance, knowledge, notice.*
Извѣстúть,	*to inform.*
Извѣстный,	*known, certain, famous.*
Извѣстіе,	*news, tidings.*
Извѣстно, неизвѣстно,	*it is known, not known.*
Извѣще́ніе,	*communication, report.*
Повѣстка,	*summons, advice, notice.*
По́вѣсть,	*a novel.*
Со́вѣсть,	*the conscience.*
Вѣкъ,	*a century, age, life-time, eternity.*
Вѣчность,	*eternity.*
Вѣно́къ,	*a wreath, garland.*
Вѣне́цъ,	*a crown.*
Вѣникъ,	*a broom.*
Вѣрить,	*to believe, trust.*
Вѣра,	*the belief, trust, creed.*
Довѣ́ріе,	*trust, confidence.*
Довѣ́рчивость,	*credulousness.*
Довѣренность,	*power of attorney, proxy.*
Вѣрно,	*it is true, authentic.*
Вѣрность,	*truth, exactness, fidelity, loyalty.*
Вѣрный,	*true, faithful, loyal.*
Вѣроя́тно,	*apparently, likely.*
Суевѣ́ріе,	*superstition.*
Вѣсить,	*to weigh.*
Вѣсъ,	*the weight.*
Вѣтвь,	*a branch.*
Совѣ́ть,	*an advice, committee.*
Совѣтовать,	*to give advice.*
Совѣща́ніе,	*consultation.*
Отвѣ́ть,	*answer.*
Отвѣ́тить, отвѣча́ть,	*to answer, reply.*
Вѣять,	*to blow, winnow.*
Вѣеръ,	*a fan.*
Вѣтръ,	*a wind.*
Вѣтренно,	*it is windy.*
Вѣтренная ме́льница,	*a windmill.*
Вѣялка,	*a winnowing machine.*
Звѣзда́,	*a star.*
Звѣрь,	*a beast.*
Невѣ́ста,	*a bride.*
Невѣ́стка,	*daughter-in-law, sister-in-law.*
Невѣ́жа, невѣ́жда,	*an ignorant.*
Невѣ́жество,	*the ignorance.*
Свѣ́жій,	*fresh.*
Свѣтъ,	*the light, the world.*
Освѣще́ніе,	*the lighting.*

Свѣча́,	*a candle.*
Подсвѣчникъ,	*a candlestick.*
Цвѣтъ,	*shade, colour, flower.*
Разноцвѣтный,	*multicolorous.*
Цвѣсти́,	*to flourish.*
Человѣкъ,	*a man.*
Человѣческій,	*human.*
По человѣчески,	*as a man.*
Безчеловѣчно,	*inhumanly.*

After д:

Дѣва, дѣвушка,	*a girl.*
Дѣдъ, дѣдушка,	*the grandfather.*
Дѣва́ть, дѣть,	*to put away.*
Одѣва́ть, надѣва́ть,	*to put on.*
Раздѣть, раздѣва́ть,	*to undress.*
Надѣяться на . . .	*to hope for, expect, rely upon.*
Дѣлать,	*to do, make.*
Дѣло,	*an act, deed, affair, business, law-suit.*

After з:

Зѣва́ть,	*to yawn.*
Прозѣва́ть,	*to let slip.*
Зѣва́ка,	*a yawner, gaper.*
Зѣвъ,	*mouth, jaws, orifice.*

Key to Exercise 30

1. The merchant resigned his position as manager twenty years ago. 2. We established ourselves along with an old friend. 3. We have acquired a good knowledge of the trade. 4. This is the place of origin of the goods. 5. The manufacture of cotton is carried on in various towns in Lancashire. 6. What is the staple industry of this part of the country? 7. Our clients do business on a large scale in machinery. 8. When the goods are received, the packages are opened. 9. Our experience has naturally brought us into close touch with all the principal houses in the market. 10. Many persons are interested in the production, sale and use of the articles in question. 11. You must be equipped with the necessary knowledge to enable you to cater successfully for the requirements of your customers. 12. We must reserve for ourselves adequate remuneration for our labour and outlay. 13. Do not forget to cover yourself for the risks you run in dealing with distant places. 14. This circumstance renders more difficult the settlement of any difficulties (misunderstandings). 15. Well, have you thought all these matters out? 16. If you are lacking a little capital, I can lend you some. 17. Talk the matter over with your friend and tell me the result. 18. Would you like to join me in such an undertaking? 19. He often told me how much he would like to establish himself along with me. 20. Do you possess ample means to meet all the liabilities you would need to contract?

Key to Exercise 31

1. Полага́ете ли Вы, что мо́жно предви́дѣть затрудне́нія съ фина́нсовой стороны́? 2. Всѣ това́рищи весьма́ ско́ро пришли́ къ согла́шенію. 3. Бу́дете ли Вы такъ любе́зны сдѣлать запи́ску о всѣхъ подро́бностяхъ имѣющагося въ виду́ договора? 4. Когда́ Вы переда́ли э́ту запи́ску Ва́шему адвока́ту? 5. Адвока́тъ нашёлъ ей зако́нную фо́рму въ ка́чествѣ А́кта о Товари́ществѣ. 6. Что бу́детъ Ва́шимъ пе́рвымъ ша́гомъ по нахожде́нію подходя́щаго помѣще́нія? 7. Е́сли бы мы имѣли небольшо́й служе́бный персона́лъ, наши слу́жащіе могли́ бы заня́ться предвари́тельными рабо́тами. 8. Э́ти предвари́тельныя рабо́ты состоя́ть гла́внымъ о́бразомъ въ извѣще́ніи имѣющихся въ виду́ покупа́телей объ учрежде́ніи на́ми въ Ма́нчестерѣ Экспо́ртной Конто́ры. 9. Въ циркуля́рахъ, содержа́щихъ э́ти подро́бности, Вы бы могли́ излага́ть всѣ вы́годы, кото́рыми, какъ надѣе́мся, покупа́тели бу́дутъ по́льзоваться при рабо́тѣ съ на́ми. 10. Благодаря́ на́шему капита́лу и о́пытности, мы надѣе́мся по́льзоваться мно́гими преиму́ществами. 11. Мно́гіе изъ на́шихъ покупа́телей освѣдомлены́ объ э́тихъ преиму́ществахъ чрезъ ихъ ли́чное знако́мство съ на́ми. 12. Мы надѣе́мся познако́миться съ Ва́ми ли́чно, когда́ Вы въ слѣдующій разъ са́ми прі́ѣдете въ А́нглію. 13. Бывъ вояжёромъ, а зате́мъ управля́ющимъ мое́й ста́рой фи́рмы, я прі́обрѣлъ мно́го драгоцѣнной о́пытности. 14. Вмѣстѣ съ пи́сьмами, объявля́ющими объ э́тихъ фа́ктахъ, Вы должны́ посыла́ть чѣ́которые краси́вые обра́зчики. 15. Въ э́тихъ пи́сьмахъ мы ука́жемъ усло́вія платежа́ и включи́мъ прейсъ-кура́нты предло́женныхъ образцо́въ. 16. Я бу́ду та́кже ука́зывать, гдѣ ну́жно, разме́ры ски́дки и другія подро́бности, давая покупа́телю возмо́жность рѣши́ть, вы́годно ли бу́детъ для него́ посыла́ть намъ кой-какіе зака́зы.

Key to Exercise 32

1. We sent off some speculative patterns and then advertised for more clerks. 2. Are these patterns likely to bring orders from the firms who will receive them? 3. They want energetic travellers to push the sale of their goods. 4. If you know languages and the requirements of the different markets with which we deal, any shipper would be pleased to engage you at a liberal salary. 5. Choose the most suitable man and give him a fair salary, but not too much, otherwise the other employees will be dissatisfied. 6. Their principle should be to pay well for the work done, by which means they will secure the best results and not easily lose the services of their employees. 7. No time must be lost in getting the traveller's pattern set together and drawing up his list of prices, i.e. both cost prices and selling prices. 8. Do not forget to procure a few letters of introduction and a circular letter of credit for our traveller. 9. With a circular letter of credit, he will be able to draw sufficient money in the various cities where he will stay, and in this way he will not need to take all he needs in one lump sum and run unnecessary risks. 10. When do you expect to receive replies and inquiries from the houses to which you have made offers? 11. As the prices of the articles we contracted for some months ago have gone up in the meantime, we shall make a good profit on these orders. 12. You should allow the clients to share in your good fortune, and then they will not forget you when they have any repeat orders to place. 13. Every prudent exporter places contracts with grey manufacturers when the market is weak, or in other words, when he thinks the prices have reached their lowest level for the time being. He can then get a remunerative price for his grey goods when prices go up, besides pleasing his clients by executing orders slightly under the rates limited. 14. Unless you examine your goods carefully, you will have no end of claims, which will reduce your profits considerably. 15. If you find discrepancies in the quality, finish or counts, you will, of course, either get adequate allowances on the prices or reject the pieces. 16. The manufacturer must give us a guarantee to compensate us in case the customer makes a claim for faulty execution. 17. Who are the consignees of these packages, and what do the latter contain? 18. When the pieces are delivered, please examine them lap by lap and throw out all jobs, as only perfect goods must be shipped. 19. After the goods are packed, they should be forwarded to their foreign destination by sailing vessel, on account of the low rate of freight. 20. Send the packages by this carrier to the railway station to be forwarded to the port and there shipped by the first steamer of the Wilson line to destination. **A. C.**

ITALIAN.—XIII

The Verb.—The Present Tense, Subjunctive Mood, of the Auxiliary Verbs, is declined as follows :—

Avere, *to have* (irreg.)	**Éssere**, *to be* (irreg.)
abbia, *I may have*	sía, *I may be*
abbia, *thou mayest have*	sía, *thou mayest be*
abbia, *he may have*	sía, *he may be*
abbiamo, *we may have*	siamo, *we may be*
abbiate, *you may have*	siate, *you may be*
ábbiano, *they may have*	síano, *they may be*

The Present Subjunctive regular endings are :—

Verbs in **-are** :
-i, -i, -i, -iamo, -iate, -ino ;

Verbs in **-ere** and **-ire** :
-a, -a, -a, -iamo, -iate, **-ano** ; as :—

The Regular Conjugations, *I buy*, etc., are as follows :—

Comprare	**Véndere**	**Partire**	**Finire**
		Sing.	
compr-i	vend-a	part-a	fin-sica
compr-i	vend-a	part-a	fin-isca
compr-i	vend-a	part-a	fin-isca
		Plur.	
compr-iamo	vend-iamo	part-iamo	fin-iamo
compr-iate	vend-iate	part-iate	fin-iate
cómpr-ino	vénd-ano	párt-ino	fin-íscano

Examples

Cerco un commesso che sáppia fare la corrispondenza,	*I seek* (am looking out for) *a clerk who can* (knows how to) *do* (the) *correspondence.*

When, after the relative pronoun **che**, *who*, etc., the attribute or qualification is *sought*, the subjunctive (here **sappia**) is used (uncertainty), otherwise the indicative is preferred, as :

Conosco un commesso che sa fare la corrispondenza,	*I know a clerk who can* (knows how to) *do* (the) *correspondence.*

In this case the qualification is *really* possessed by the clerk, not sought (certainty).

Se volete ch'io ve lo faccia (subj. of fare), fátevelo voi stesso !	*If you do not wish that I should do it for you, do it* (for yourself) *yourself.*

The past tense following **se**, *if*, is generally in the Subjunctive Mood, but the present tense is generally in the Indicative Mood. It should be noted that the Future Indicative is often used in Italian after **se**, where in English the Present is used, as **Se avrete il tempo**, *If you have time.*

Should, *may*, and *might* are often used in English to express the Italian Subjunctive Mood. It should also be observed that where the subject or nominative of the second verb is different from that of the first verb, the second verb is, in certain cases, preferably put into a Finite Tense, as in the above example : **Ch'io ve lo faccia,** *That I should do it*, etc. ; whereas in English the Infinitive is preferred, i.e. *If you do not wish me to do it*, etc. This difference in construction is worthy of particular attention, as it occurs at every moment.

Sebbene comprò tutta la partita, non gli demmo nessuno sconto,	*Though he bought the whole lot, we did not give him any discount.*

After the conjunction **sebbene** the indicative is here used, because the action is not open to any doubt. This is the case with all those conjunctions which otherwise require the Subjunctive Mood after them.

VOCABULARY

preténdere, *to claim.*
saputo (sapere), *known.*
l'invenzione (f.), *invention.*
dica, diciamo (pres. subj. of dire), *to say.*
schiettámente, *plainly, candidly.*
Istato (following a consonant, instead of stato), *position, state.*
unire, *to join, unite.*
la prática, *practice, experience.*
la conoscenza, *knowledge, acquaintance.*
il francese, *French* (language).
il servizio, il servigio, *service.*
dubitare, *to doubt.*
il senso, *sense.*
l'aiúto (m.), *help, assistance.*
la destinazione, *destination.*
capace, *capable.*
mezzanotte, *midnight.*
mezzogiorno, mezzodì, *midday.*
ritirarsi, *to retire.*
liquidare, *to liquidate.*
il débito, *debt.*
aver ragione, *to be right.*
accaparrare, *to secure, get hold of.*
la tessitura, *weaving mill.*
il latore, *bearer.*
sino a, *to, as far as, up to.*
la concorrenza, *level, equivalent, value, competition.*
la filanda, *spinning mill.*
fornire, *to supply.*
la dovizia, *abundance.*
la roba, *merchandise goods.*
vile, *poor, low, cheap.*
símile, *like, similar.*
il livello, *level.*
il posto, *post, situation.*
occupare, *to occupy.*
soltanto, *only, simply.*
giusto, *just.*
ossía, *or whether.*
congedare, *to discharge, dismiss.*
summentovata, summenzionata, (f.) *above-mentioned.*
il ribasso, *allowance.*
l'avviso (m.), *opinion.*
parziale, *partial.*

Exercise 25

Translate into English :—

1. Non pretendiamo éssere i primi che abbiamo saputo, di questa invenzione. 2. Vi prego che glielo diciate senza che loro lo sáppiano. 3. Che lo dica o no, non m'importa nulla ; non temo che lo sáppia lúi. 4. Se non vogliono che lo faccia io, che me lo dicano francamente, affinchè io sappia cosa fare. 5. Se lo vedrete, abbiate la bontà di dirgli tutto precisamente come ve l'ho spiegato. 6. Hanno detto loro schiettamente : " Se non volete che lo facciamo nói, fátevelo vói stessi ! " 7. Scrive loro quella lettera affinchè síano in istato di eseguire l'òrdine dovutamente. 8. Cércano due commessi che uníscano alla prática degli affari la conoscenza dell'inglese, del tedesco, dell' italiano e del francese.

Exercise 26

Translate into Italian :—

1. We are pleased that they have found the qualities we want, and we shall give them a large order. 2. I am surprised that you have not known about the invention of which all are speaking (all speak). 3. If he does not wish them to do it for him, let him do it for himself, and then he will be satisfied. 4. We are looking out for a cashier who is capable of occupying (of to occupy) this post. 5. I have a cashier who is capable of doing everything that I ask him to (di) do. 6. Whether you say it or not, we do not care ; we simply wished to do what is just. 7. It is impossible for you to arrive at your destination before midnight, if you start at midday to-day.

Key to Exercise 18

1. Le etichette sulle pezze saranno molto belle e avrete una buona véndita di queste mercanzíe. 2. Sono sempre venuti alla medésima (stessa) ora e sono partiti tre ore più tardi. 3. L'anno sarà presto finito, ma il lavoro sarà fatto (terminato) prima di allora. 4. Noi ed i vostri amici abbiamo visitato le stesse (medésime) città per compare diversi artícoli. 5. Gli órdini contenuti nelle léttere ricevute col corriere d'oggi sono rilevanti. 6. Avremo molto piacere di eseguire il vostro órdine a prezzi ben ristretti (a prezzi ultimíssimi). 7. Il nostro principale sarà qui domattina di buon'ora per discútere questo soggetto (affare). 8. Le loro léttere érano piene di osservazioni spiacévoli circa l'esecuzione dei loro órdini. 9. Nella cassa di mercanzíe (merci) ricevuta stamattina (stamane) vi érano parecchie pezze di questa medésima qualità. 10. Avrò fatto questo per voi prima del vostro arrivo da Parigi. 11. Non avevo parlato tanto tempo coll'esportatore nel magazzino del mío amico. 12. Avranno scelto le pezze più larghe di tutta la partita.

Key to Exercise 19

1. We shall know to-morrow who has done that. 2. When shall you see the packages in the warehouse ? 3. What shall you see when you come ? 4. We shall see a lot (much), but you will see little. 5. When shall you go to the theatre, to-day, to-morrow, or the day after to-morrow ? 6. What shall you write in your friend's office ? 7. Have you done this to-day, yesterday, or the day before yesterday ? 8. Soon we shall set out for Rome. 9. We shall be able to see our friends this afternoon. 10. Where shall you be this evening ?

Key to Exercise 20

1. Gli studenti vedranno i negozianti ed i banchieri alle case degli amici. 2. Compreremo queste mercanzíe sulla parola del venditore. 3. Abbiamo fatto questo per i compratori nelle case straniere. 4. Vedremo il collo quando saremo coi clienti alle case dei negozianti. 5. Otterremo dalle Autorità la licenza per imbarcare le casse. 6. Sono ricco adesso, ma morirò (morró) póvero se non potrò ottenere il danaro. 7. Avrete mandato i campioni ai clienti quando verrò al vostro studio questo dopopranzo (pomeriggio) ? 8. Non aveva molto tempo questa mattina, ma ha scritto tutte le fatture e tutte le léttere. 9. Dove andrete stasera—al teatro o al concerto collo studente e coi fabbricanti ? 10. Avremo pagato tutte le nostre fatture questa settimana, senza fallo.

Key to Exercise 21

1. I was speaking to the buyer whilst you were writing to the debtors. 2. Last year, whilst he was ill, I went to Palermo to collect some money. 3. He approved of what we had done. 4. They asked me to give you their kind regards. 5. They paid you the account without asking for the discount. 6. We read for an hour and then we went away. 7. On several occasions he said he was ready to settle the amount due to them. 8. Tell us when you insured the sending and for what amount. 9. We told him that last year our friend has been (was) very unfortunate. 10. Did you not remember the difficulty we had in obtaining the payment from those clients ?

Key to Exercise 22

1. Esaminammo i di lúi campioni e gli offrimmo i prezzi che troverete sul listino acchiuso. 2. Ieri voi leggeste le di lúi léttere e le di léi risposte. 3. Vi incaricammo di far loro i nostri saluti e voi prometteste farlo. 4. Avemmo tante traversíe l'anno prima della Guerra che perdemmo tutto il nostro desiderio di continuare a lavorare con quel mercato. 5. Perchè ve ne andaste prima di finire la vostra corrispondenza ? Non ebbi il tempo di farla, come sapete, perchè il mío convoglio partiva alle quattro. 6. Vi andárono la settimana passata con un preventivo per un impianto completo di macchinario ? 7. Assicurammo l'invío per l'importo che menzionate nella vostra léttera della stessa data, cioè, per cinquemila lire italiane.

Key to Exercise 23

1. It would be impossible for us to have said that. 2. I should look out for a clerk who knew how to correspond in French and Italian. 3. I did not deny that he was guilty. 4. Did you think we had written it ? 5. We should like him to come to us immediately, for fear that we should not understand each other well. 6. They were very glad that their traveller was able to take so many orders. 7. You told them to prepare the sending immediately. 8. I should be afraid he would leave before me. 9. They consented that you should execute the first part. 10. However rich they might be, they should not refuse this small favour. 11. It was the biggest thing we had ever seen. 12. Whatever were their reasons, they should not have taken the orders unless we had given them permission to do so. 13. He would tell you it, if he could, even though he were punished for it later. 14. Unless they forbade (it to) us, we should do it, until we succeeded. 15. It would seem to them that we would not wish to do it, for fear they should punish us.

Key to Exercise 24

1. M' invieresti una rimessa se poteste, o preferireste ch'io aspetassi finchè non cadesse il cambio. 2. A meno che non eseguíssero l'órdine prima della fine del mese, lo daréi ad un'altra casa (detta), benchè questo potrebbe costarmi più. 3. Rincrescerebbe loro (a loro) se lúi non voltasse ? 4. Se l'avéssimo saputo, ve lo avremmo scritto. 5. Malgrado che io ci vedessi soltanto un piccolíssimo márgine di profitto, accetteréi la loro offerta con piacere. 6. Se io vi aiutassi, quanto mi dareste ? 7. Non potrébbero fare la corrispondenza a meno che non li aiutássimo. 8. Supposto che io volessi fare questo, quanto mi darébbero ? 9. Io faréi il negozio, se soltanto mi déssero una percentuale ragionévole di commissione. 10. Sono sicuro ch'egli farebbe questo per me, quand'anche dovesse soffrirne più tardi. 11. Se fosse necessario ch'io lo facessi súbito súbito, lo faréi, quand'anche me ne puníssero più tardi. 12. Affinchè lo sapeste súbito, vi manderéi un telegramma da Torino. 13. A meno che non me lo proibíssero, aspetteréi finchè non ricevessi la vostra léttera.

A. C.

SPANISH.—XIII

The Verb.—Double Participle. Certain verbs have double past participles, the one regular, the other irregular, the first kind being employed with the auxiliary verb "haber" to form compound tenses, whilst the latter partake of the nature of adjectives, and are not always used to form compound tenses. Take, for examples, the following :—

Incluir, *to enclose*, incluido, incluso.

La letra que hemos **incluido** en nuestra carta.
The bill which we have enclosed in our letter.
La letra está **inclusa** en mi carta.
The bill is enclosed in my letter.
Las letras son siempre **inclusas** (Passive Voice) en las cartas por José.
The bills are always enclosed in the letters by Joseph.

It will thus be seen that **ser** and **estar** are generally followed by the adjectival form.

The following is a list of the principal verbs with double participles, and it may be remarked that the tendency in some instances is to use the adjectival participle in preference to the regular or verbal past participle, as **roto** :

Examples

Los carreteros han roto la mayor parte de las botellas.
The carters (carriers) *have broken the greater part of the bottles.*
Las botellas están rotas.
The bottles are broken.
Las botellas son generalmente rotas por los carreteros.
The bottles are generally broken (Passive Voice) *by the carriers.*

It may help the student by pointing out the difference in English between *opened* and *open*, *saved* and *safe*, where the verbal and adjectival nature respectively of the two words is clearly seen.

Infinitive	*Regular Past Participle* with **haber**	*Irregular Past Participle*
concluir, *to conclude*	concluido	concluso
concretar, *to concrete*	concretado	concreto
corregir, *to correct*	corregido	correcto
dirigir, *to direct*	dirigido	directo
distinguir, *to distinguish*	distinguido	distinto
erigir, *to erect*	erigido	erecto
exceptuar, *to except*	exceptuado	excepto
excluir, *to exclude*	excluido	excluso
exentar, *to exempt*	exentado	exento
expresar, *to express*	expresado	expreso
extraer, *to extract*	extraído	extracto
faltar, *to fail*	faltado	falto
fechar, *to date*	fechado	fecho
fijar, *to fix*	fijado	fijo
imprimir, *to print*	imprimido	impreso
incluir, *to include*	incluido	incluso
infundir, *to infuse*	infundido	infuso
insertar, *to insert*	insertado	inserto
invertir, *to invest*	invertido	inverso
juntar, *to join*	juntado	junto
limpiar, *to clean*	limpiado	limpio
manifestar, *to manifest*	manifestado	manifiesto
prender, *to seize*	prendido	preso
prescribir, *to prescribe*	prescribido	prescrito
producir, *to produce*	producido	producto
profesar, *to profess*	profesado	profeso
proveer, *to provide*	proveído	provisto
repletar, *to fill* (full)	repletado	repleto
restringir, *to restrict*	restringido	restricto
romper, *to break*	rompido	roto
salvar, *to save*	salvado	salvo
secar, *to dry*	secado	seco
soltar, *to loosen*	soltado	suelto
sujetar, *to subject*	sujetado	sujeto
surgir, *to anchor*	surgido	surto
suprimir, *to suppress*	suprimido	supreso
suspender, *to suspend*	suspendido	suspenso
torcer, *to twist*	torcido	tuerto
zafar, *to rid*	zafado	zafo.

VOCABULARY

el motivo, *the motive, reason.*
persuadir, *to persuade.*
entero (adj.), *entire.*
la primera de cambio, *the First of Exchange.*
las segundas, i.e. las segundas de cambio, *the Seconds of Exchange.*
por conducto, *by, through, per.*
leído (past participle of **leer**), *read.*
presentar, *to give, present.*
en punto, *exactly.*
á la hora en punto, *exact to time.*
los preparativos, *the preparations.*
el agente, *the agent.*
amarillo, *yellow.*
el puerto, *the port.*
estar de cuidado, *to be very ill.*
estar con cuidado, *to be uneasy.*
advertido, *warned.*
advertir, *to advise, warn.*
dar largas, *to prolong.*
debido, *due.*
venir de perilla, *to come at the nick of time.*
hacer de tripas corazón, *to pluck up courage.*
chanzas aparte, *joking aside.*
de aquí en adelante, *henceforward, henceforth.*
jugar limpio, *to act fair, to play fair.*
falto de, *deprived of, lacking, being without.*
faltar de, *to be without, to lack, be deprived of.*
completamente, *completely.*
los recursos, *the resources, means.*
el conocido, *the acquaintance* (person).
necesitar, *to need, to want.*
¡ tráigame V. ! (from traer), *bring* (to) *me !*
el guarismo, *the figure* (arithmetical).
todavía, *yet, still.*
satisfecho (past participle of satisfacer), *satisfied.*
en almacén, *in stock, in the warehouse, in store.*
pocos, *few.*
el pasajero, *the passenger* (*traveller*).
sano y salvo, *safe and sound.*
mismos, *themselves.*
convencer, *to convince.*
tener razón, *to be right.*
lo necesario, *the needful, what is necessary.*
el asunto, *the matter, subject, object.*
valer la pena, *to be worth while.*
la cara, *the face.*
la bribonada, *the shabby trick.*
tantos, *so many.*
el pariente, *the relative, relation.*

participar, *to participate.*
el robo, el hurto, *the theft.*
prender, *to imprison.*
descubrir, *to discover.*
descubierto, *discovered.*
la inocencia, *the innocence.*
el acusado, *the person accused.*
en vista de, *in consequence of, in view of.*
la prueba, *the proof.*
tomar, *to take.*
el gobierno, *the government.*
referir, *to refer.*
referido, *referred aforesaid.*
el diario, *the newspaper.*
las mercancías, *the goods, merchandise.*
el procedimiento, *the proceeding.*
poner un telegrama, *to send a telegram.*
ciertamente, *certainly.*
¡ Vaya V. ! (from) **ir**), *Go!*
el fin, *the end.*
protestar, *to protest.*
consultar, *to consult.*
sobre, *as to.*
los mejores medios, *the best means.*
caer á, *to overlook* (of a window, etc.).
espacioso, *spacious.*
el patio, *the courtyard.*
sin embargo, *for all that, nevertheless.*
defenderse, *to defend oneself.*
debidamente, *duly, in a proper manner.*
el extràcto, *the extract.*
agradecido, *thankful, grateful.*
el estampadòr, *the printer.*

Exercise 23

Translate into English :—

1. Sé muy bien que por varios motivos han roto ellos para siempre con aquella casa. 2. Sepan Vs. que en la remesa de hoy hemos incluido todo lo que les debíamos. 3. Estén Vs. persuadidos de que sabremos explicar todo á su entera satisfacción. 4. Las letras inclusas en nuestra carta por el último correo son las primeras de cambio, las segundas que corresponden las hemos incluido ayer en la carta que les mandamos á Vs. por conducto de nuestro viajante. 5. Leída toda la carta fuimos á ver al fabricante. 6. Dicho eso, me presentó el cliente muestras de todo lo que había comprado antes. 7. Llegados á la hora en punto, tuvimos la felicidad de ver al representante de la casa antes de su salida. 8. Hechos que fueron los preparativos, pusimos un telegrama á nuestro agente. 9. Sabiendo que existe fiebre amarilla en aquel puerto y que está de cuidado nuestro representante, êstaremos con cuidado hasta que lleguen noticias definitivas. 10. Advertido del peligro, nuestro amigo no quiso más dar largas al negocio y por lo tanto pagó la cantidad debida.

Exercise 24

Translate into Spanish :—

1. These desks will not go into (find room in) our office. 2. After reading (Después de leída) this explanation, he will want to see the goods themselves. 3. Let him come, I will soon convince him that we are (have) right. 4. They will know it to-morrow, and then they will do the needful in the matter. 5. It will be worth while to see his face when he knows (Present Subjunctive) that we have discovered the shabby trick he has played us. 6. Joking aside, I shall do all I can when I come to see you next week. 7. So many persons would not find room easily in this house. 8. Being entirely without means, I visited then all my relatives and friends, but they were unable to lend me any money. 9. I should certainly send you a telegram if I wanted the money before then. 10. Go to Mr. González and explain to him that if we do not get his remittance before the end of the month we shall put the matter into the hands of our lawyers. 11. The bill being protested (tr. protested the bill), we went to consult with a lawyer as to the best means of obtaining (the) payment. 12. Do not prolong this affair as we are uneasy and wish to conclude the contract.

Key to Exercise 16

1. Por mucho que trate V. de encaminar los géneros, no pueda. 2. Es necesario empeñar que haga aquel error. 3. En caso que me confíen Vs. sus órdenes, las ejecutaré con todo cuidado. 4. No negamos que él quiera evitar el pagamento. 5. Sea que V. lo diga o no, es verdad. 6. Vs. pueden tener los géneros á aquel precio, con tal que acepten Vs. nuestros condiciones. 7. ¿Pero supuesto que nuestros giros sean desairados al presentación ? ¿Qué haremos entonces ? 8. Quiero la mejor calidad que sea posible obtener en el mercado. 9. Ellos no quieren hacerlo, bien que les hemos ofrecido mejores condiciones. 10. Aunque les concedan Vs. todo lo que quieran ellos, no quedarán satisfechos. 11. Sin que V. mande las mercancías inmediatamente, las dejarán á su disposición. 12. Preferimos que V. lo sepa directamente de él mismo. 13. Les suplicamos á Vs. que no crean aquellos rumores mentirosos. 14. Me ha pedido que vaya al fabricante y que le explique la situación. 15. Suponen que sea como V. dice, pero no están ciertos. 16. Sentimos que no hayamos podido hallar algo que iguale sus muestras. 17. Cuando venga aquí de nuevo, traiga V. su libro de caja consigo. 18. ¿Creen ellos que haya posibilidad que recibamos los géneros antes de aquella fecha ? 19. Cuando V. va á ver á los fabricantes, lleve V. siempre consigo los dibujos, para que sepan lo que V. desee. 20. Como quiera que sea el asunto, no le diga V. que vaya á exponer la situación á su amigo.

Key to Exercise 17

1 For fear you should not know the customer, I will give you a description of him. 2. When the bill falls due, you must meet it, that is to say, pay it. 3. It is necessary for you to reduce our loss as much as possible, if you wish us to go on giving you orders. 4. Turn the key and the door will open. 5. I contribute to the funds of all the charitable societies to which they contribute. 6. Unless he should ask for an explanation of such behaviour, he will not know what to do. 7. It is a pity you should sleep so late each morning, and it will be necessary to get up earlier in future. 8. I request you in future to think more about what you are doing. 9. Come here and tell me what you have heard and seen in the city. 10. Although we are worth so much, we shall never receive so large a salary.

Key to Exercise 18

1 Quisiera (querría) que V. me pusiese (pusiera) un telegrama cada día durante mi ausencia. 2. Tuerza la llave, pero la puerta no se abre tan fácilmente como esperábamos. 3. Si sólo supiesen cuánto tenemos que hacer, no nos suplicarían hiciésemos (hiciéramos) (note that *que* is sometimes omitted after verbs like *suplicar*) todo ese trabajo. 4. Quisiéramos que V. pasara a vernos mañana o pasado mañana, si le fuera posible. 5. Hicieron esto afín de que (para que) V. sintiese (sintiera) la necesidad de obrar con energía (enérgicamente). 6. Si su padre de V. muriera (muriese), V. quedaría sin un solo amigo en el mundo. 7. Vs. no les dijeron (contaron) aquella historia para que rieran (riesen), pero de modo que supieran (conocieran) el estado actual de las cosas. 8. Avíseme V. unos pocos días de antemano cuando vaya a vencer (cuando venza) la letra, y le mandaré los fondos necesarios.

A. C.

THE SPECTRE OF THE BROCKEN

is really only a much magnified image of the beholder thrown on the bank of mist which at sunrise and sunset commonly enshrouds the Brocken, the highest point (3,740 feet) in the Harz Mountains, some twenty miles south-west of Halberstadt.

Continued from Vol. V., page 487.

MATHEMATICS:

Contributor: — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.
(M. A. Lewenz, M.A.[Lond.]).

MECHANICS.—XVI

102. Equilibrium and the Centre of Gravity.

If a heavy body be supported at its centre of gravity, it will be in equilibrium in every position; for as the centre of gravity is at the point of support the weight of the body must always act through the point of support; further, the weight has no moment about any line passing through the point of support.

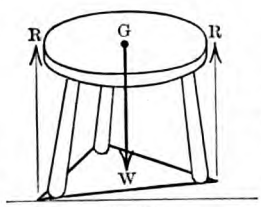


Fig. 93A.

103. *If a body rest on a hard plane surface, it will stand or fall according as the vertical from the centre of gravity falls within or without the base.*

The **base** is defined as the area enclosed by a flexible cord drawn tight round the points of support of the body.

Thus the base of a three-legged stool is the area of the triangle of which the feet form the angular points.

Let us place the stool (i) on a horizontal surface and (ii) on an inclined plane.

The forces acting on the body are its weight w acting vertically downwards through G and the reactions of the plane on the three legs acting perpendicular to the plane.

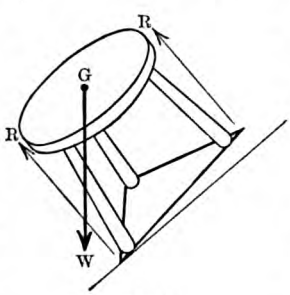


Fig. 94.

Now in case (i) the resultant of the reactions will be a force acting vertically upwards at some point in the plane, and this force must act in the same straight line as the weight, for if we take any point A at the edge of the base, then the moment of the weight about the point A will tend to press the stool down on to the surface, and unless this is counterbalanced by the resultant of the reactions, the stool will sink through the surface. If, however, the surface is hard the stool will **stand** on it, i.e. the forces will be balanced.

But if as in case (ii) the stool stand on an inclined plane we have a different result. The reactions have a resultant at some point in the base perpendicular to the plane. Now take a point A at the edge of the base nearest the point where the vertical force w cuts the plane, then the moment of the weight w about A will tend to lift the part of the stool which stands highest off the plane, and the resultant of the reactions cannot counterbalance this since it also tends to lift the body off the plane. Therefore the stool will topple over.

These facts may easily be experimentally tested.

104. Stable, Unstable and Neutral Equilibrium.

If a body is in a position of equilibrium and, when it is slightly displaced, tends to revert to its original position, then its equilibrium is called *stable*.

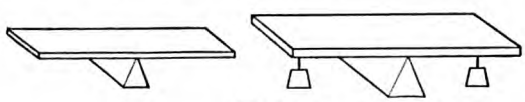
If a body is in a position of equilibrium and, when it is slightly displaced, tends to move farther from its original position and to assume a new position of equilibrium, then its original equilibrium is called *unstable*.

If a body is in a position of equilibrium and, when it is slightly displaced, remains in its new position, its equilibrium is called **neutral**.

Thus a walking stick suspended by its crook is in stable equilibrium, while the same when balanced by its tip on a man's finger is in unstable equilibrium, while a pencil lying on a horizontal surface is in neutral equilibrium.

In the case of neutral equilibrium, the centre of gravity is supported in every position; thus a uniform sphere resting on a horizontal plane is always in neutral equilibrium, so is an egg resting on its side and any cylinder resting on its spherical surface. Also a disc suspended at its centre of gravity is in neutral equilibrium.

The stability and instability of equilibrium depend on the height of the centre of gravity; the lower the centre of gravity the greater the stability.


(a) Fig. 95. (b)

Suppose a plank be balanced on a knife edge, as in Fig. 95 (*a*). It is in unstable equilibrium, and will be easily upset. But if, as in Fig. 95 (*b*), weights are attached to each end, the centre of gravity of the whole system is lowered, and the plank will return to its original position

even if slightly displaced, i.e. the equilibrium is stable. Again let us consider a rectangular block on a horizontal plane in positions Fig. 96 (i) to (iv).

In (i) its equilibrium is stable, but by applying a horizontal force high enough, we may tilt it till it assumes position (ii) where it rests in unstable

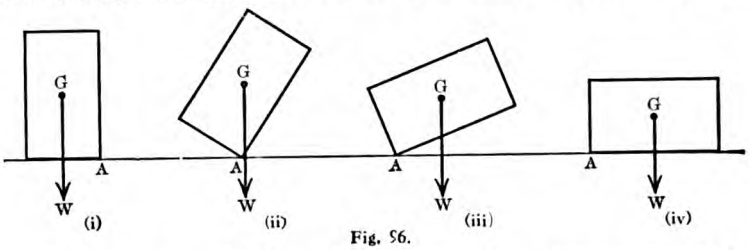


Fig. 96.

equilibrium on the edge through A. In (iii) it is shown changing from the unstable position (ii) to the stable position (iv). In this the centre of gravity G is the lowest and the position is most stable.

The amount of stability may be measured by the force required to tilt the block.

In the case of a partially spherical body, resting on a spherical surface, the equilibrium is stable if the centre of gravity is below the centre of the

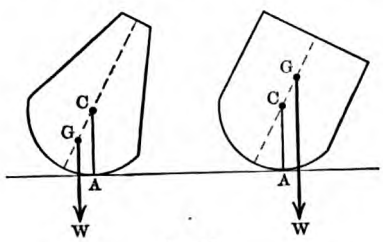


Fig. 97.

spherical portion, for then the moment of the weight about the point of support A tends to bring the body back to its original position, but the equilibrium is unstable if the centre of gravity is above the centre of the spherical portion, for then the moment of the weight tends to move the body farther from its original position (Fig. 97).

105. Miscellaneous examples from the London Matric. Exam.

(1) A uniform triangular plate weighing one pound has an extra weight of one pound attached to it at one of its angular points. It is free to rotate about a horizontal axis at right angles to its surface and which passes through the point of intersection of its median lines. Show in which positions the plate will be in stable and unstable equilibrium respectively. Has it any position of neutral equilibrium ?

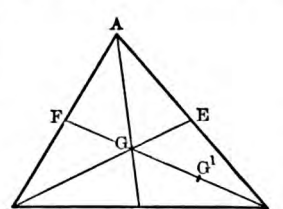


Fig. 98.

Let A B C be the triangular plate, A D, B E, C F the medians intersecting at G.

Let the weight of 1 lb. be suspended at C.

The weight of the plate, the plane of which is vertical, acts at G vertically downwards and its magnitude = 1 lb.

The weight attached = 1 lb. and acts vertically downwards at C.

Hence the centre of gravity of the plate and weight combined must be at G where G^1 is the middle point of C G.

For equilibrium G^1 must be in the same vertical straight line as G, which is the point of support, hence we have two positions of equilibrium, one with G^1 vertically below G and one with G^1 vertically above G.

(1) Let G^1 be vertically below G, then if the plate be slightly displaced it will tend to revert to its original position, hence the equilibrium is stable.

(2) Let G^1 be vertically above G, then if the plate be slightly displaced the moment of the resultant through G^1 about G would tend to move the plate farther from its original position, hence the equilibrium is unstable.

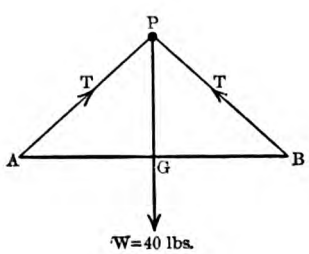
The student can readily supply the figures.

The plate has no position of neutral equilibrium since it is not suspended at the centre of gravity of the system.

(3) A uniform bar, 16 feet in length, and weighing 40 lb. is hung by a string 20 feet long, attached to the two ends of the bar, and passing over a smooth peg. In what positions can the bar rest, and how much will the tensile force on the string be ?

Let A B be the rod, G its middle point, P the peg.

The tensions in A P and B P are equal since the peg is smooth, hence their resultant acts at P and



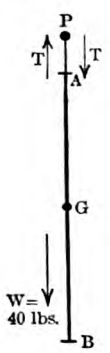


Fig. 99.

must bisect the angle A P B, also since this resultant is the equilibriant of the weight of 40 lb. (which acts at G), it must be vertical and pass through G.

Hence P G bisects angle A P B.

CASE 1. A B is horizontal:

Triangles A P G and B P G are equal in all respects,

$\therefore$ P A = P B = $\frac{1}{2}$ length of string = 10 inches,

A G = B G = $\frac{1}{2}$ length of rod = 8 inches,

$\therefore$ P G = $\sqrt{100 - 64}$ = 6 inches.

Resolving vertically, W = twice T resolved along P G

$$= 2 \times \frac{6}{10} T = \frac{6T}{5}$$

$$\therefore T = \frac{5w}{6} = \frac{5 \times 40}{6} \text{ lb.} = 33{\cdot}3 \text{ lb.}$$

CASE 2. A B is vertical, then A P and B P are also vertical,

Then B P − A P = B A = 16 inches
B P + A P = 20 inches

∴ 2 B P = 36 in. ∴ B P = 18 in. and A P = 2 in. and G P = 10 in.

Both W and T act vertically, hence 2T = 40 lb., ∴ T = 20 lb.

(4) A cubical block of stone weighing 150 lb. rests on the ground, which is so rough that the block will not slide. It is to be tilted up so as to rest on the edge. Find the least force which, applied at the opposite edge in a horizontal direction will begin to tilt the block, and find the least force in any direction at that edge which will begin to tilt it.

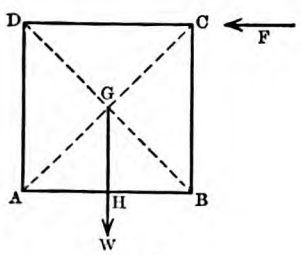


Fig. 100.

Let the square A B C D with the horizontal base line A B, be a median section of the block. Then the centre of gravity of the block will be G, the point of intersection of A C and B D.

To turn the block about the edge through A we must apply a horizontal force F at C such that the moment of F about A just exceeds the moment of W about A.

If the moment of F about A = moment of W about A, then $F \times AD = W \times AH$ ∴ $F = \frac{W \times AH}{AD}$

but $AH = \frac{1}{2} AD$ and W = 150 lb.

∴ F = ½ 150 lb. = 75 lb. wt.

Hence the force must just exceed 75 lb. wt.

The direction of F may be varied and clearly the magnitude of F is least when the perpendicular from A to the line of direction of F is greatest. Now the greatest possible length of this perpendicular is A C. Hence F is least when it acts perpendicular to A C and then we have

$$F \times AC = W \times AH \therefore F = W \times \frac{AH}{AC}$$

Now $AC = \sqrt{2}\, AB = \sqrt{2} \times 2\, AH$

$$\therefore F = \frac{150}{2\sqrt{2}} \text{ lb. wt.} = \frac{75}{2}\sqrt{2} \text{ lb. wt.}$$
$$= 53{\cdot}03 \text{ lb. wt.}$$

Hence in this case F must just exceed 53·03 lb. wt.

(5) A table consists of a uniform circular board weighing 9 lb., supported by 3 vertical legs fixed at equal distances round the circumference. A weight of 12 lb. placed on the edge of the table midway between 2 legs is just sufficient to cause the table to overturn. Find the weight of each leg.

Let A E, B F, C K be the legs of the table, D the weight of 12 lb. placed at the middle point of the arc A D C.

A B C, E F K are equilateral triangles.

The table will overturn about the line E K.

Since D is the middle point of arc A D C, angle A B D = angle C B D. Hence triangles A B H, C B H are equal in all respects and therefore A H = C H, i.e. B D is a median of the triangle.

Hence the centre of gravity of the whole table lies at G on B D.

Consider the moments about the line E K.

The weight of the table acts vertically downwards through G and its moment about E K = 9 × G H.

The weight of 12 lb. acts vertically downwards through D and its moment about E K = 12 × H D.

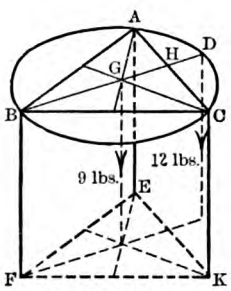


Fig. 101.

The weights of the legs A E and C K act vertically downwards through E and K and therefore these have no moment about E K.

The weight W of the leg B F acts vertically downwards through F and its moment about E K = W × B H.

As long as there is equilibrium

W × B H + 9 × G H = 12 × H D

Now B H = 3 G H

And since G is the centre of the circle, G D = G B = 2 G H

∴ G H = H D

Hence W × 3 G H + 9 G H = 12 G H

∴ 3 W + 9 = 12 ∴ W = 1 lb.

Hence if the weight of 12 lb. is just sufficient to upset the table each leg weighs just under 1 lb.

(6) A sphere 4 inches in diameter is loaded so that its centre of gravity is 1 inch from the centre; the weight of the loaded sphere is 4 oz. When the sphere is resting on a horizontal table, what is the least weight which must be fastened to the surface of the sphere, and where must it be fastened to make the equilibrium of the sphere unstable?

The loaded sphere is in equilibrium, hence its centre of gravity must lie in the vertical from the centre to the point of contact with the table.

When the weight is attached the sphere is still in equilibrium, therefore the weight must be attached where this vertical cuts the surface of the sphere, i.e. either at the top or at the bottom. But the sphere with the weight is to be in unstable equilibrium, therefore the centre of gravity must be raised above the centre of the sphere, and hence the weight must be placed at A at the top.

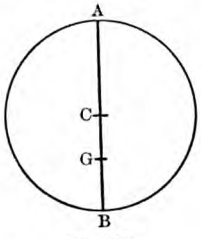


Fig. 102.

Let W be the weight; it will be 2 inches from C.

If C were the centre of gravity W × 2 in. = 4 oz. × 1 in. ∴ W = 2 oz.

Hence to raise the centre of gravity above C we must attach a weight which just exceeds 2 oz.

Exercise 17

(1) An equilateral triangular lamina is suspended by threads fastened to two of its angular points. The directions of the threads pass through the centre of mass of the lamina and one of them is horizontal and has a tension of 1 lb. Find the tension of the other thread and the weight of the lamina.

(2) Masses of 1, 2, 5 and 10 gm. are placed in this order round the corners of a rectangle whose sides are 12 cm. and 3 cm. long, the 1 and 2 gm. being at the ends of a side 12 cm. long. Determine the position of the centre of mass of the system.

(3) A horizontal plank 40 feet long and 1 cwt. in weight projects 10 feet over the edge of a cliff. Find the weight of the heaviest man who could walk to the end of the plank without causing it to fall over the cliff.

(4) The wheels of a coach are 5 feet apart, and the centre of gravity is 10 feet from the line of contact of the wheels and ground on either side. To what height may the wheels on one side run up a bank before the coach is upset.

(5) A bar projects 6 in. beyond the edge of a table and when 2 oz. is hung on to the projecting end the bar just topples over; when it is pushed out so as to project 8 in. beyond the edge, 1 oz. makes it topple over. Find the weight of the bar, and the distance of its centre of gravity from the end.

(6) A weight resting on a smooth inclined plane is held in position by a horizontal force. Draw a diagram exhibiting the directions and magnitudes of the forces acting; and calculate the force necessary to hold a hundredweight on a plane tilted 30° from the level (*a*) if acting horizontally, (*b*) if acting at the best angle.

Key to Exercise 16

(1) 1 foot 3 in. from heavier particle.
(2) 2 feet 6 in. from the lighter sphere.
(3) At a height $\frac{2}{5}x$ above the base.
(4) $\frac{4}{15}$ in. from the centre of the sphere 3 ft. in diam.
(5) The point at which the axes of the two cylinders touch.
(6) At a distance $\frac{a}{9}$ from the centre on the straight line joining the centre to the middle point of the side opposite to the removed triangle.
(7) If E and D be the middle points of the longer and shorter arms respectively, and B the angular point, and if E be a point on C D such that C E = $\frac{1}{3}$ C D, then the point is at F on E B where E F = $\frac{1}{3}$ E B.

M. A. L.

CO-ORDINATE GEOMETRY.—II

11. The Straight Line.

If a straight line or curve be defined geometrically by a property common to all its points, some algebraic relation must exist which is satisfied by the co-ordinates of all the points on the straight line or curve. This relation is called the *equation* of the straight line or curve.

Conversely, all points whose co-ordinates satisfy a given equation, lie on the curve which is called the **locus** of that equation.

For instance, if a straight line be drawn parallel to the axis of Y at a distance a from the axis, the abscissae of all points on this line equal the constant quantity a. Hence $x = a$ is the equation of such a line.

Conversely a line drawn parallel to the axis of Y and at a distance a from it, is the locus of the equation $x = a$. Again, if x, y be the co-ordinates of a point P which lies on the circumference of a circle whose centre is the origin O, and whose radius is r, the square of the distance O P $= r^2 = x^2 + y^2$. Hence the co-ordinates x_1 y of any point on the circumference satisfy the equation $x^2 + y^2 = r^2$. Therefore $x^2 + y^2 = r^2$ is the equation of the circle.

Conversely the locus of the equation $x^2 + y^2 = r^2$ is a circle whose centre is at the origin and whose radius $= r$.

Exercise 4

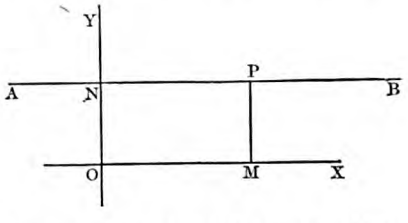
(1) A point moves so that the sum of the squares of its distances from 2 fixed points $(m_1\ o)$ and $(-m_1 o)$ is constant and equal to $2n^2$. Find the equation of the locus.

(2) A point moves so that its distance from the axis of y is half its distance from the origin, find the equation of the locus.

(3) Draw a figure (on squared paper) of the locus which satisfies the equation $y = 2x + 3$.

12. *To find the equation of a straight line drawn parallel to one of the axes of co-ordinates.*

Let A B be any straight line drawn parallel to the



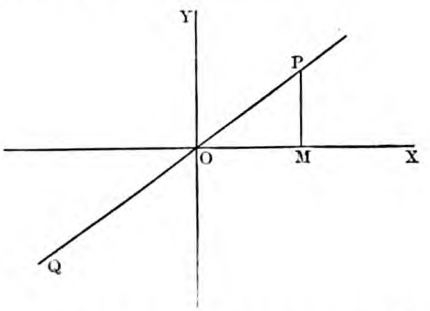
axis of X, and let P be any point on A B which meets the axis of Y in N. Let O N $= b$.
Then the ordinate M P $=$ O N $= b$.

Hence $y = b$ is the equation of a straight line drawn parallel to the axis of X at a distance b from it.

13. *To find the equation of a straight line which passes through the origin.*

Let Q P be a line passing through the origin O.

Take any point P on this line, then, although its co-ordinates O M, M P vary in length, the ratio $\frac{MP}{OM}$ = tan X O P remains constant.



Let tan X O P = m, and let x and y be the co-ordinates of P.

Then y = M P = O M × m = mx, i.e. $y = mx$ is the required equation.

14. *To find the equation of any straight line.*

Let A B be any straight line meeting the axes of X and Y in A and N.

Let O N = c, let tan O A N = m.

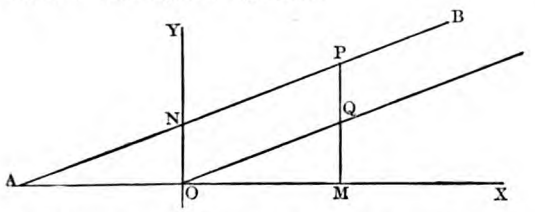
Let x, y be the co-ordinates of any point P on the line. Draw P M parallel to the axis of Y, cutting O X in M. Draw O Q through the origin, parallel to A B, and cutting P M in Q.

Then M P = M Q + Q P = O M tan M O Q + O N.

Now M P = y, O M = x and tan M O Q = tan X A B = m

$\therefore y = mx + c$,

which is the required equation.



So long as the same line is considered, m and c are constants, for m is the tangent of the angle between the positive direction of the axis of X and the part of the line above the axis of X, while c is the intercept on the axis of Y.

The equation $y = mx + c$ may be made to represent any straight line whatever, by giving suitable values to m and c.

Thus for any straight line passing through the origin c = 0 and the equation becomes $y = mx$.

Again, suppose a line making an angle of 60° with the axis of X cuts the axis of Y at a distance = 2 units from the origin, the equation would then become $y = \sqrt{3}x + 2$, for m = tan 60° = $\sqrt{3}$ and c = 2.

15. *To show that every equation of the first degree represents a straight line.*

In order to do this we need only show that if we take any three points on the locus, the area of the triangle having these points as its vertices is zero.

The most general form of an equation of the first degree is

$$A x + B y + C = 0 \qquad \text{(i)}$$

Let (x', y'), (x'', y''), (x''', y''') be points on the locus, then

$$A x' + B y' + C = 0 \qquad \text{(ii)}$$
$$A x'' + B y'' + C = 0 \qquad \text{(iii)}$$
$$A x''' + B y''' + C = 0 \qquad \text{(iv)},$$

Eliminating A B and C from the equations (ii), (iii) and (iv), we have $x'y'' - x''y' + x''y''' - x'''y'' + x'''y' - x'y''' = 0$ (v).

But the area of the triangle the co-ordinates of whose angular points are $(x'y')$, (x'',y'') and $(x'''y''')$ is $\frac{1}{2}\{ x'y'' - x''y' + x''y''' - x'''y'' + x'''y' - x'y''' \}$ (*see* § 5, Vol. V., p. 486)

$\therefore$ from (v) the area of this triangle = 0

i.e. $Ax + By + C = 0$ represents a straight line.

16. *The equation* $Ax + By + C = 0$ *may be reduced to the form* $y = mx + c$.

Dividing by B we have $y = -\frac{A}{B}x - \frac{C}{B}$.

Here the constants $-\frac{A}{B}$ and $-\frac{C}{B}$ correspond to the constants m and c.

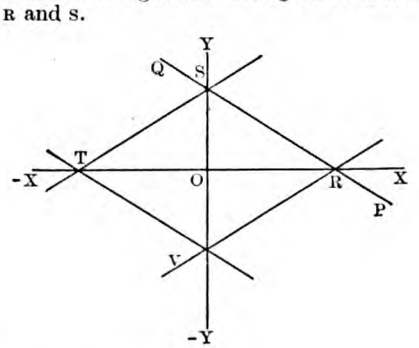
That is $-\frac{A}{B}$ is the tangent of the angle which the straight line makes with the axis of X, and $-\frac{C}{B}$ s the intercept on the axis of Y.

Clearly the lines $y = mx + c$ and $y = m'x + c'$ will be parallel if $m = m'$, since they both make the same angle with the axis of X.

Hence the lines $Ax + By + C = 0$ and $A'x + B'y + C' = 0$ will be parallel if $\frac{A}{B} = \frac{A'}{B'}$.

17. *To express the equation of a straight line in terms of the intercepts which it cuts off on the axes.*

Let P Q be a straight line cutting the axes of X and Y in R and S.



Let O R = a and O S = b.

The equation of P Q may be written in the form $Ax + By + C = 0$

or $\frac{A}{C}x + \frac{B}{C}y + 1 = 0$ (i).

Now R is a point on P Q $\therefore$ its co-ordinates must satisfy (i). Now the co-ordinates of R are $x = a$, $y = o$.

Hence $\frac{A}{C}a + 1 = 0$ or $\frac{A}{C} = -\frac{1}{a}$ (ii).

Similarly S is a point on P Q and its co-ordinates are $x = o$, $y = b$.

Hence $\frac{B}{C} b + 1 = 0$ or $\frac{B}{C} = -\frac{1}{b}$ (iii).

Substituting these values in (i) we get

$$\frac{x}{a} + \frac{y}{b} = 1.$$

This is the equation of the straight line P Q in terms of its intercepts a and b on the axes.

Clearly the position of the line will vary with the signs of a and b.

Thus $-\frac{x}{a} + \frac{y}{b} = 1$ represents the line S T whose intercepts on the axes are $-a$ and b.

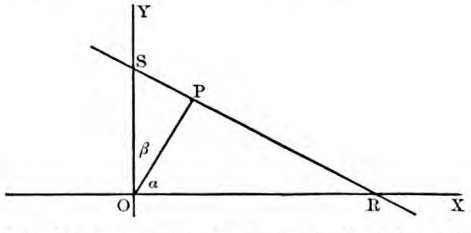
Similarly $-\frac{x}{a} - \frac{y}{b} = 1$ represents T V

and $\frac{x}{a} - \frac{y}{b} = 1$ represents V R.

The equation $\frac{x}{a} + \frac{y}{b} = 1$ is sometimes written in the form $lx + my = 1$ where $l = \frac{1}{a}$ and $m = \frac{1}{b}$.

18. *To express the equation of a straight line in terms of the perpendicular on it from the origin and the angles which that perpendicular makes with the axes.*

Let the straight line make intercepts O R $= a$ and O S $= b$ on the axes of X and Y.



Let the perpendicular O P from the origin on to R S be $= p$.

Now the equation of the line R S is

$\frac{x}{a} + \frac{y}{b} = 1$ (i) (*see* § 17).

Multiply this throughout by p, then

$\frac{p}{a} x + \frac{p}{b} y = p$ (ii).

Now $\frac{p}{a} = \cos \alpha$ and $\frac{p}{b} = \cos \beta$.

Hence $x \cos \alpha + y \cos \beta = p$ (iii) is the required equation.

Since α and β are complementary angles, we may write the equation in a form involving only one angle, i.e.

$$\left.\begin{array}{l} x \cos \alpha + y \sin \alpha = p \\ \text{or } x \sin \beta + y \cos \beta = p \end{array}\right\} \text{(iv)}.$$

Consider the general form of the equation

$$Ax + By + C = 0.$$

This can be reduced to either of the forms (iv)

Divide the equation by $\sqrt{A^2 + B^2}$, then

$$\frac{A}{\sqrt{A^2 + B^2}} x + \frac{B}{\sqrt{A^2 + B^2}} y = -\frac{C}{\sqrt{A^2 + B^2}}$$

Now we may take $\frac{A}{\sqrt{A^2 + B^2}}$ and $\frac{B}{\sqrt{A^2 + B^2}}$ as the cosine and sine respectively of the same angle, since the sum of their squares equals unity.

Hence $x \cos \alpha + y \sin \alpha = p$ where α is the angle which the perpendicular from the origin on the line $Ax + By + C = 0$ makes with the axis of X and $-\frac{C}{\sqrt{A^2 + B^2}}$ is the length of that perpendicular.

The student should note that the position of the line represented by $x \cos \alpha + y \sin \alpha = p$ varies with the signs of $\cos \alpha$ and $\sin \alpha$, and that we have 4 cases which correspond to those in § 17.

If $\alpha < 90°$, $\cos \alpha$ and $\sin \alpha$ are both positive.

If $90° < \alpha < 180°$, $\cos \alpha$ is negative and $\sin \alpha$ is positive.

If $180° < \alpha < 270°$, $\cos \alpha$ is negative and $\sin \alpha$ is negative.

If $270° < \alpha < 360°$, $\cos \alpha$ is positive and $\sin \alpha$ is negative.

19 If we wish to find the equation of a straight line which satisfies any two conditions, we may express its equation in any one of the forms

(i) $y = mx + c$ (ii) $\frac{x}{a} + \frac{y}{b} = 1$ (iii) $lx + my = 1$

(iv) $x \cos \alpha + y \sin \alpha = p$ (v) $Ax + By + C = 0$.

We then determine the value of the constants which depend on the two conditions which the line has to satisfy.

Example :—

Find the equation of the straight line which passes through the point $(-1, 3)$ and makes equal intercepts on the axes.

Let the equation of the line be $\frac{x}{a} + \frac{y}{b} = 1$

since the intercepts on the axes are equal, $a = b$.
Also since the point $(-1, 3)$ is on the line

$$\frac{-1}{a} + \frac{3}{b} = 1 \quad \therefore -\frac{1}{a} + \frac{3}{a} = 1$$

$\therefore a = 2$.

Hence the equation of the line is $\frac{x}{2} + \frac{y}{2} = 1$.

Exercise 5

What are the intercepts on the axes made by the following straight lines ?

(1) $5x + 3y = 15$. (2) $3x - y = 6$. (3) $2y - x + 4 = 0$. (4) $3x - 2y = 0$.

Draw on squared paper the straight lines.

(5) $x - y = 2$. (6) $2x + 5y + 9 = 0$. (7) $2y - 4x = 0$. (8) Find the equation of the straight line passing through the point (2, 3) and making equal intercepts on the axes.

Key to Exercise 1

(3) $\sqrt{68}$, $\sqrt{50}$, $\sqrt{106}$. (6) $x = \frac{a + a^1}{2}$, $y = \frac{b + b^1}{2}$.

(7) $(\frac{1}{2}, -1\frac{1}{2})$, $(-\frac{1}{2}, -\frac{3}{2})$, $(3, -1)$.

Key to Exercise 2

(1) (*a*) 10, (*b*) $\frac{5}{2}$, (*c*) 29. (2) 20.

Key to Exercise 3

(1) $(0, 1)$, $(\sqrt{3}, 1)$, $(3\sqrt{2}, -3\sqrt{2})$.

(2) $(\sqrt{2}, \frac{3\pi}{4})$ $(5, \tan^{-1} -\frac{4}{3})$.

M. A. L.

Continued from Vol. V., page 504.

BUSINESS AND COMMERCE:

***Contributors*:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).**

CHOOSING A CAREER.—XLI

Electrical Workers. — To become a dealer in electrical appliances considerable experience is necessary, if the stock is to be kept and managed as a fully representative one. Beginners should enter large shops as junior assistants and work their way up, and there is a call for expert fitters and for practical, competent men who can undertake small repairs.

On account of the large stock necessary it requires considerable capital to open even an unpretentious establishment, but the profit upon individual sales is proportionately high. In this particular business, however, the greatest return is to be made from the installation of electric light and from repairs ; and the man most likely to succeed is he who has devoted some part of his youth to the training of an electrical engineer and the remainder to time-serving in an electrical supply business.

Electric cables are made in large factories on the Thames and the Tyne and in other engineering centres. Boys begin as learners, and as they progress become improvers and labourers before they are fully-qualified workers. Wages are generally paid by the hour.

The various electric lighting companies employ men to go round reading meters, account collectors, testers and fitters, wiremen, road and mains workers, inspectors and others. Generally speaking, all the classes are recruited from boy workers who begin either in the shops or offices and work their way upwards.

Engravers and Process Workers.—There is very little demand for the services of wood engravers, and etching on steel is only followed to a limited extent. So far as engraving as a career is concerned at present it has to do mainly with the production of printing blocks for line, half-tone and colour work ; and the various processes are to a great extent purely mechanical, and very largely photographic.

We may take it that the workers employed in an engraving establishment, whether it be a separate commercial undertaking or merely a branch of a newspaper or other printing works, consist of studio men who photograph the original drawings ; those who prepare the plates ; those who give the rough graving, routing out the deep spaces ; those who finish off and the mounters.

In other offices there are electrotypers and foundrymen, whose work lies in the making first of moulds and then of replica castings or electrotypes from the original blocks. In this calling, therefore, there is an opening for men and occasionally for women possessed of artistic ability and who will learn to use engraving tools. The work is taught in the art classes of most of our technical schools.

Farriers.—In country districts blacksmiths and farriers usually take apprentices to live in. In such cases the apprentice engages for a period of five years. There is a society of shoeing-smiths that grants both registration and diplomas to its members ; and the business, when combined with general smithing, is a profitable one, despite the increasing use of motor transport.

Firemen.—So far as the Fire Brigades are concerned, they are almost entirely recruited from among the ex-sailors, and a large proportion of the men have served in the Royal Navy.

The actual rules of entry vary with the different municipalities. Applicants for positions as firemen should present themselves at the chief station of the brigade they wish to join, taking with them one or two references from previous employers or their papers if they have been to sea. In the metropolis the chief station is at *Southwark Bridge Road, London, S.E.*1, where applicants are seen on weekdays at 9 a.m., by an official detailed for the purpose. A. C. M.

BOOK-KEEPING.—XXXV

THE general principles of double entry are applicable to Mining Accounts just as they are to the accounts of any other trade, but special circumstances require special consideration.

In cases where the owner of land does not work the minerals but leases the land for working purposes, he exacts rent. As the amount payable must depend to a certain extent upon output, the amount will fluctuate from year to year.

In order that the income shall not be varied deliberately by small output, the lessor generally requires payment of a *minimum rent* or *dead rent*. As, however, land might be quickly worked out by increased pressure of working, the minimum rent would not cover every contingency.

Payments are therefore made to depend upon the number of tons of mineral raised from the mine or quarry. Such payment is called *mineral royalty*. Where the amount raised is such that the royalty exceeds the minimum rent, the royalty is the sum payable. Where, however, the royalty would be less than the minimum rent, the minimum rent is required. It sometimes happens that the royalties payable, if based on the amount of output, would be much less than the minimum rent. In such case the balance is known as *overpaid royalties*, and the deficiency in weight of mineral raised is called *shortworkings*.

In order that the arrangement shall be equitable as between lessor and lessee, a mining lease generally gives the lessee the right to recoup himself out of future royalties when such exceed the dead rent. If there is a reasonable prospect of shortworkings being recovered, the amount may be shown as an asset in the Balance Sheet.

The following is the method which is recommended for entering up the books of account in relation to mining leases. During periods when the royalties would be less than the minimum rent and the minimum rent is therefore payable, the process is :—

(*a*) To debit Royalties Account with royalties on the actual output.

(*b*) To credit the Landlord's Account with the dead rent.

(*c*) To debit the difference between royalties and dead rent to a Redeemable Dead Rent Account or Shortworkings Account, as follows :—

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Royalties	*Dr.*	– – –	
Shortworkings Acc.	*Dr.*	– – –	
To Landlord ..		*Cr.*	– – –

being —d. per ton on — tons raised.

When the royalties are in excess of the minimum rent, the following entries would be made :—

(*a*) Debit Royalties Account as before.

(*b*) Credit the Landlord's Account with the minimum rent.

(*c*) Credit Shortworkings Account with the balance required to recoup previous shortworkings.

(*d*) Any surplus on the royalties after such Shortworkings Account has been credited

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				£	*s.*	*d.*	£	*s.*	*d.*
1st year	Royalties	*Dr.*	250	–	–			
	Shortworkings	*Dr.*	150	–	–			
	To Landlord					400	–	–
	6d. per ton on 10,000 tons raised.							
2nd year	Royalties	*Dr.*	375	–	–			
	Shortworkings	*Dr.*	25	–	–			
	To Landlord					400	–	–
	6d. per ton on 15,000 tons.							
3rd year	Royalties	*Dr.*	425	–	–			
	To Landlord					400	–	–
	„ Shortworkings					25	–	–
	6d. per ton on 17,000 tons.							
4th year	Royalties	*Dr.*	450	–	–			
	To Landlord					400	–	–
	„ Shortworkings					50	–	–
	6d. per ton on 18,000 tons.							
5th year	Royalties	*Dr.*	500	–	–			
	To Landlord					400	–	–
	„ Shortworkings					100	–	–

will be credited to the Landlord's Account thus :—

JOURNAL.

Royalties	*Dr.*	– – –	
To Landlord ..		*Cr.*	– – –
,, Shortworkings Account ..		*Cr.*	– – –

being —d. per ton on — tons raised.

These accounts would then be posted to Royalties, Shortworkings and Landlord's Accounts in the Ledger, an example being as follows :—

The Northern Colliery Company, Limited, took a lease of a coal mine for a period of twenty years from January 1, 19... Under the lease a royalty of 6d. per ton upon output was payable, with a minimum rent of £400 per annum, with power to recoup "shortworkings" over the first five years of the lease.

Show the Royalty, Shortworkings and Landlord's Accounts in the books of the Colliery Company, assuming that the annual outputs for the first five years of the lease were :—

10,000 tons ; 15,000 tons ; 17,000 tons ; 18,000 tons ; 20,000 tons, respectively.

(London Chamber of Commerce.)

LEDGER.

Dr. ROYALTY ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d.
1st year	To Landlord..	250	–	–	1st year	By Trading Account ..	250	–	–
2nd year	,, ,, ...	375	–	–	2nd year	,, ,, ,,	375	–	–
3rd year	,, ,, ...	425	–	–	3rd year	,, ,, ,,	425	–	–
4th year	,, ,, ...	450	–	–	4th year	,, ,, ,,	450	–	–
5th year	,, ,, ...	500	–	–	5th year	,, ,, ,,	500	–	–

Dr. SHORTWORKINGS ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d.
1st year	To Landlord..	150	–	–	1st year	By Balance c/d	150	–	–
2nd year	To Balance b/d	150	–	–	2nd year	By Balance c/d	£175	–	–
	,, Landlord..	25	–	–					
		£175	–	–			£175	–	–
3rd year	To Balance b/d	175	–	–	3rd year	By Royalties	25	–	–
						,, Bal. (unredeemed) c/d	150	–	–
		£175	–	–			£175	–	–
4th year	To Balance b/d	150	–	–	4th year	By Royalties	50	–	–
						,, Bal. (unredeemed) c/d	100	–	–
		£150	–	–			£150	–	–
5th year	To Balance b/d	£100	–	–	5th year	By Royalties	£100	–	–

Dr. LANDLORD'S ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d.
1st year	To Income Tax at 1/2	23	6	8	1st year	By Royalties	250	–	–
	,, Cash	376	13	4		,, Shortworkings ..	150	–	–
		£400	–	–			£400	–	–
2nd year	To Income Tax at 1/3	25	–	–	2nd year	By Royalties	375	–	–
	,, Cash	375	–	–		,, Shortworkings	25	–	–
		£400	–	–			£400	–	–
3rd year	To Income Tax at 2/6	50	–	–	3rd year	By Royalties	400	–	–
	,, Cash	350	–	–					
		£400	–	–			£400	–	–

4th and 5th years as in 3rd year.

When under the lease there is the right to recoup the amount paid in excess of royalties from future royalties in excess of minimum rent, the amount of rent to be charged to the trading account is the royalty on the actual amount of mineral raised. If, however, there is no right or likelihood of recoupment, the minimum rent will be charged to trading account.

Both in manufacturing businesses and colliery undertakings it is quite common for machines to be obtained on the hire purchase system. This will entail a certain amount of specialised book-keeping. Usually in this system the plant obtained is not the property of the purchaser until the instalments have been paid. Further it will be clearly seen that the moneys paid in total do not represent the present value of the articles purchased, but credit being given, it follows that a certain proportion of the price must be represented by interest. It will be necessary, therefore, in the case of hire purchase to separate that portion of each instalment which represents capital expenditure from that portion which represents revenue expenditure, and as during the period in which the hiring continues the plant or machinery is in use, it will, like all other plant and machinery, suffer depreciation. It is essential that provision should be made for this.

Let us suppose that the X.Y.Z. Shirt Manufacturing Company fits up its new works with complete sets of machines on the hire purchase system, the machines to be paid for by instalments in a period of six years, the annual instalments being of £250 each. The Sewing Machine Supply Company charges interest at the rate of 5 per cent. on the yearly balances, and the X.Y.Z. Shirt Manufacturing Company wishes to depreciate the plant at the rate of 10 per cent. The cash value of the plant may be taken to be the present value of an annuity of £250 for six years at 5 per cent. Inwood's tables give us the value of an annuity of £1 for six years at 5 per cent. as £5·07569, and this multiplied by 250 amounts to £1,268 18s. 6d., which may be taken to be the value of the plant if paid for in cash. The first instalment of £250 paid at the end of the first year will be divided as between capital and revenue. A portion of it will represent interest at 5 per cent. on £1,268 18s. 6d., the remainder being capital expenditure. In the following year the interest will be a smaller amount, although the total instalment remains £250, capital expenditure being slightly higher. This difference between capital and revenue increases to the last year, on account of the fact that the balance outstanding on the account gradually decreases and therefore the interest gradually decreases over the period.

The following are the necessary entries :—

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			£	s.	d.	£	s.	d.
1st year		Hired Plant Account	*Dr.*	186	11	1		
		Plant Hire Account (5 per cent. Interest on £1,268 18s. 6d.)	*Dr.*	63	8	11		
		To Sewing Machine Supply Co.					250	–	–
2nd year		Hired Plant Account	*Dr.*	195	17	8		
		Plant Hire Account (5 per cent. Interest on £1,082 7s. 5d.)	*Dr.*	54	2	4		
		To Sewing Machine Supply Co.					250	–	–
3rd year		Hired Plant Account	*Dr.*	205	13	6		
		Plant Hire Account (5 per cent. Interest on £886 9s. 9d.)	*Dr.*	44	6	6		
		To Sewing Machine Supply Co.					250	–	–
4th year		Hired Plant Account	*Dr.*	215	19	2		
		Plant Hire Account (5 per cent. Interest on £680 16s. 3d.)	*Dr.*	34	–	10		
		To Sewing Machine Supply Co.					250	–	–
5th year		Hired Plant Account	*Dr.*	226	15	2		
		Plant Hire Account (5 per cent. Interest on £464 17s. 1d.)	*Dr.*	23	4	10		
		To Sewing Machine Supply Co.					250	–	–
6th year		Hired Plant Account	*Dr.*	238	1	11		
		Plant Hire Account (5 per cent. Interest on £238 1s. 11d.)	*Dr.*	11	18	1		
		To Sewing Machine Supply Co.					250	–	–

Dr. HIRED PLANT ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d
1st year	To Sewing Machine Co.	£186	11	1	1st year	By Depreciation 10 per cent. on £1,268 18s. 6d. ..	126	17	10
						By Balance c/d ..	59	13	3
		£186	11	1			£186	11	1
2nd year	To Balance b/d ..	59	13	3	2nd year	By Depreciation 10 per cent. on £1,142 0s. 8d. ..	114	4	1
	To Sewing Machine Co.	195	17	8		By Balance c/d ..	141	6	10
		£255	10	11			£255	10	11
3rd year	To Balance b/d ..	141	6	10	3rd year	By Depreciation 10 per cent. on £1,027 16s. 7d. ..	102	15	8
	To Sewing Machine Co.	205	13	6		By Balance c/d ..	244	4	8
		£347	–	4			£347	–	4
4th year	To Balance b/d ..	244	4	8	4th year	By Depreciation 10 per cent. on £925 0s. 11d. ..	92	10	1
	To Sewing Machine Co.	215	19	2		By Balance c/d ..	367	13	9
		£460	3	10			£460	3	10
5th year	To Balance b/d ..	367	13	9	5th year	By Depreciation 10 per cent. on £832 10s. 10d. ..	83	5	1
	To Sewing Machine Co.	226	15	2		By Balance c/d ..	511	3	10
		£594	8	11			£594	8	11
6th year	To Balance b/d ..	511	3	10	6th year	By Depreciation 10 per cent. on £749 5s. 9d... ..	74	18	7
	To Sewing Machine Co.	238	1	11		By Balance c/d ..	674	7	2
		£749	5	9			£749	5	9
Begin. of 7th year	To Balance b/d ..	£674	7	2	Begin. of 7th year	By Plant Account ..	£674	7	2

Note the balance carried down each year is the value of the asset as it will appear in the Balance Sheet. Thus at the end of the 3rd year Hired Plant in the Balance Sheet is £244 4s. 8d.

PLANT ACCOUNT.

		£	s.	d.					
7th year	To Hired Plant Acc.	674	7	2					

Dr. PLANT HIRE ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d.
1st year	To Sewing Machine Co.	63	8	11	1st year	By P. and L. Account	63	8	11
2nd ,,	,, ,, ,,	54	2	4	2nd ,,	,, ,, ,,	54	2	4
3rd ,,	,, ,, ,,	44	6	6	3rd ,,	,, ,, ,,	44	6	6
4th ,,	,, ,, ,,	34	–	10	4th ,,	,, ,, ,,	34	–	10
5th ,,	,, ,, ,,	23	4	10	5th ,,	,, ,, ,,	23	4	10
6th ,,	,, ,, ,,	11	18	1	6th ,,	,, ,, ,,	11	18	1

Dr. SEWING MACHINE SUPPLY CO. *Cr.*

		£	s.	d.			£	s.	d.
1st year	To Cash	250	–	–	1st year	By Sundries	250	–	–
2nd ,,	,, ,, ...	250	–	–	2nd ,,	,, ,, ...	250	–	–
3rd ,,	,, ,, ...	250	–	–	3rd ,,	,, ,, ...	250	–	–
4th ,,	,, ,, ...	250	–	–	4th ,,	,, ,, ...	250	–	–
5th ,,	,, ,, ...	250	–	–	5th ,,	,, ,, ...	250	–	–
6th ,,	,, ,, ...	250	–	–	6th ,,	,, ,, ...	250	–	–

Note the balance carried down each year is the value of the asset as it will appear in the Balance Sheet.

Carefully note that depreciation is charged on the cash value in the first year and on the diminishing cash value in subsequent years, with a result that the asset will appear in the books at the end of the time when all the instalments have been paid at its proper value.

Exercise

Work the following Exercise :—

The Speedy Motor Cab Co., Ltd., was registered with a Nominal Capital of £30,000, divided into 10,000 Ordinary Shares of £1 each, and 20,000 Six per cent. Preference Shares of £1 each.

From the " Trial Balance " which is given at the foot of this page, prepare Trading and Profit and Loss Accounts for the year ended December 31, 1913, and a Balance Sheet as on that date :—

Before preparing the Accounts, the following adjustments are necessary :—

Charge Depreciation on Plant and Machinery, and Fixtures and Fittings, at 10 per cent. per annum.

Charge Depreciation on Taxicabs at 5 per cent. per annum.

Reserve for Renewals, £500.

Reserve for Rates owing, £18 7s. 6d.

Reserve for Insurance paid in advance, £170 1s. 6d.

The takings of the cabs on December 30 and 31 amounted to £171 8s. 3d., but were not paid in by the Drivers until January 1.

Write off one-third of the Preliminary Expenses Account.

The value of the Stock in hand as on December 31, 1913, was agreed at £1,486 10s. 9d.

(Royal Society of Arts.)

Key :—Trading Account.—Tyres, Petrol, Washing and Cleaning, Repairs.

Gross Profit	£8,852	16	10
Net Profit	£1,330	8	0
B/S Total	£31,172	9	5

TRIAL BALANCE.

	£	s.	d.	£	s.	d.
Ordinary Share Capital Account				10,000	–	–
Preference Share Capital Account				18,267	–	–
Calls in arrear on Preference Shares	8	10	–			
Stock in hand (January 1, 1913)	1,305	8	7			
Cash in hand	28	9	3			
Bank Overdraft				603	5	4
Cab Earnings				18,697	19	5
Salaries	1,187	10	3			
Tyres	4,906	3	11			
Insurance	1,521	8	–			
General Expenses	278	9	–			
Plant and Machinery	1,451	9	–			
Fixtures and Fittings	1,126	17	–			
Taxicabs	28,000	–	–			
Debtors and Creditors	89	17	3	710	2	–
Reserve for Renewals (January 1, 1913)				500	–	–
Profit and Loss Account (Balance, December 31, 1912)	748	3	5			
Rent of Taximeters	465	10	–			
Licences	312	8	–			
Petrol (less Payments by Drivers)	874	8	6			
Training Drivers	103	5	4			
Washing and Cleaning Cabs, etc.	2,606	8	2			
Repairs	1,810	12	5			
Rent, Rates and Taxes	953	8	7			
Lighting	189	5	4			
Directors' Fees	250	–	–			
Preliminary Expenses	458	9	6			
Legal Expenses and Audit Fees	102	5	3			
	£48,778	6	9	£48,778	6	9

F. H.

Continued from page 10.

ENGLISH LANGUAGE AND LITERATURE:

***Contributors*:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).**

ETHICS.—I

WE may say that the science of Ethics is concerned with human character and conduct. It is in one sense an analysis of a man's temperament and soul—subjects which are of far greater, and even more practical, interest to the average man than he is usually willing to admit. Ethics is intended not only to tell us *what* we should do with our life in this world—which is moderately easy, since religion is already at hand as a guide—but *why* we should do it, which is by no means so easy.

Practical Aims

The study of Ethics, properly applied, should give us the *reason* of the things taught by our religion. But it should do more than this. It should open the minds of mankind to the evils which are remediable, and should therefore help to bring an end to the kind of wrongdoing of which we see so many examples in everyday life. For it must not be supposed for one moment that Ethics is without its practical side. It represents to the soul what the profession of medicine does to the body. We all know when we are ill, and we frequently know what should be done to cure our illness; but it is only the doctors who know what is going on beneath the covering of bodily tissue, and who understand the rational reasons and process of the diseases, and, as a result, the precise meaning of the cures.

It is the lot of comparatively few men to be physicians—in fact, were every man a doctor, the profession would starve for lack of patients!—but there is no reason why every one should not be a student of Ethics. Even pessimists will not deny that the great majority of the inhabitants of this world are anxious to do the right thing. Very well then, Ethics may be taken simply as an attempt to point out the right thing, and the right way to do it.

This last is by no means unimportant. For it is in the power of Ethics to show that the right thing may be done in the wrong way. Ethics, in fact, is nothing if not analytical. Supposing, for instance, that a large sum of money has been given by a rich man for an object of charity, the man will have acted rightly in doing the right thing. This verdict will sound ridiculously superfluous—until Ethics chooses another instance, and judges it. Supposing that the rich man has given the sum of money to the charitable cause in order to obtain a peerage or some other such benefit for himself. In that case the verdict of Ethics is perfectly clear that the man has done the *right* thing in the *wrong* way.

Morality and Conduct

It would be foolish to suppose that everything connected with Ethics is as simple as all this. Ethics sets out, in fact, to deal with some of the most difficult problems that life presents. If you like, you may call it the science of morality. But in this case you must understand by morality something more comprehensive than mere abstinence from evil.

There seems no doubt that morality, rightly understood, is a force of which a man should not be actively conscious that he possesses. We will not attempt to elaborate this point yet, but this much may safely be taken for granted. If a man is leading the moral life *he will be unconscious of the fact.*

The explanation of this undoubted phenomenon in the moral life is that a man who has trained himself to the proper methods of existence performs actions which are in

tune with his real self. He does not perform good acts after reflection and hesitation merely because they *are* good acts. He performs them because they are acts natural to the condition of his soul. It is when he ceases to act in this way that his higher self revolts.

There are many people who are strongly possessed with the idea that such rather vaguely understood terms as morality and the welfare of the soul in general are incompatible with the idea of happiness, as popularly understood. Now Ethics will have nothing of this. If we attempt to analyse happiness some conception of its attitude towards the subject will be gleaned.

It has been taught by the Christian Religion that to regard earthly happiness as an end is wrong.

The science of Ethics, too, has accepted this precept, but Ethics has done more than this. It has analysed the conditions of happiness, and has found out the *reasons* of the precept. Earthly happiness, *as an end*, has no existence. Therefore it is wasteful, unpractical, and wrong for man to use up valuable energy in endeavouring to reach the unattainable.

Towards a Good End

All this sounds very sweeping, and the science of Ethics does not put the matter as crudely as this. Nevertheless, this is what its conclusions amount to. There is no doubt that happiness in this world is achieved in the struggle towards a good end. But when the end has been achieved the struggle and the happiness in that particular achievement is done. In this respect man may be said to resemble a root which spends its strength in sending flowers up into the world. When its strength has caused a fine blossom to emerge, is the root permitted to spend the rest of its life gazing upwards in rapture at the beautiful thing? Not in the least. The flower shrivels, and becomes a totally dead object.

There are doubtless many people who regard the science of Ethics as opposed to Religion in some form or other. But there does not seem to be the slighest reason why this should be the case. On the contrary, there is surely no reason why Religion and Ethics should not walk hand in hand, each working for the benefit of the other.

There are, of course, many different interpretations of Ethics, just as there are many different interpretations of Religion, but in the main, who can deny that the two work towards the same end? We may endeavour to show by the following illustration one of the aims of Ethics.

Imagine a child walking by the side of a high wall which shuts him off from the sight of the smiling country on the farther side. If you admit the wall to be an allegorical one, this is the lot of all children. Now Ethics urges that the child should be lifted up in order that it may see over the wall—otherwise he may never know what is on the other side of it; not even when he is grown up, for then the man that was once that child will have become so accustomed to the sight of the high wall, that he will be unable to discern anything else.

So much for some of the principal objects of Ethics. It now remains to show some of the forces and circumstances with which Ethics has to deal. W. H. K.

PHILOSOPHY.—XII

We must now consider the problem of the existence of a world around us, which we shall call the extra-mental world, in order to avoid implying anything as to its actual nature, i.e. whether it is mental or material in character.

Does such a world exist? Or is it like "the baseless fabric of a vision," merely an imaginary world?

The Reality of the External World

Such questions may appear absurd to some people, but so did the idea of flying a hundred years ago. We must not be daunted by apparent absurdities. After all, there is nothing logically ridiculous in the tenet of Pure Idealism that the only existents are our own mental phenomena, sensations, thoughts, desires, etc., and that everything else is dream or hallucination.

It may be contended that the objects around us are directly apprehended and that our knowledge of them is immediate and direct. To this psychologists reply that our knowledge consists of sense-data, i.e. of subjective existents, and there is nothing to show that these are true representations of things outside—a problem which will be considered later on.

When we use the word "real" we mean thereby the "actual," and not the "material" as opposed to the "mental"; and we may call the two opposed points of view the "life-a-reality" and the "life-a-dream" hypotheses. Why is it we call the events of waking life real and those of dream life unreal?

The untutored savage takes the opposite view; developed man has the instinctive belief that the external world is a fact. This may be regarded as some evidence, but it cannot be gainsaid that our so-called instinctive beliefs frequently lead us astray, as when a loving mother instinctively believes that her ne'er-do-well son is a paragon of all the virtues.

What constitutes the difference between dream life and waking life? The sensations in each case are undoubtedly real, and the sense-data are essentially similar although not always. "Dreams are true while they last." The differences seem to be more of degree than of kind: thus the will is much less operative in dreams, and memory plays a more important part in waking life.

Dream Life and Waking Life

Apart from physiological grounds, the main difference appears to be that of coherence. The events in a dream often follow one another in a very different way to what they do in waking life. In the latter they succeed one another in a constant way—in the former they are very often arranged in a higgledy-piggledy manner. Then again, the phenomena of dream life are more easily explained on the assumption of the reality of our waking life than the latter are if we take dream life to be real. And lastly, there is the practical consideration that if we ordered our conduct in waking life in accordance with the view that the dream life was the real one, we should come to grief.

For these and other reasons we feel justified in asserting that waking life has a greater degree of reality than dream life; "in the moment of experience" dreams appear to have objective existence, but reason revises the verdict of sense and declares that it is not only "not proven" but very improbable. We cannot, however, conclude that waking life is *absolutely* real, because there may (conceivably) be another life to which it may have the same relation as dream life has to it. At any rate, such considerations indicate that it is at least possible to adduce arguments to support the instinctive belief in the reality of waking life.

Are there any arguments to support the view that there is an extra-mental world?

The chief argument which appeals to the writer is the fact that during sensation our sensory organs receive stimuli from without. What the nature of the given stimulus may be, whether it consist of vibrations of air or of the æther, whether material or mental, or whatever be the source from which the stimulus came, is immaterial: during sensation the nerve-ends of the sensory organs do receive a message from outside, therefore there must be *something* there, and the something "announces itself" in sensation. Further, if we accept the pragmatical criterion of truth (that truth and error are to be discriminated by the success or failure which follows their application to human ends), we cannot but admit the reality of the extra-mental world, for the alternative hypothesis would be quite unworkable in practical life.

We will take it, then, for granted—if not proven—that "something-or-other-we-don't know-what" exists besides our own mental processes. This unknown x we will call the "object" in contradistinction to the "subject" to which its existence is signalled in sensation; and under "object" we shall include all the objects of common sense.

The belief that objects persist or endure when they are not observed is also instinctive, and very difficult to substantiate. It is of no use to call in the evidence of other people to prove that my house is still standing when I am a hundred miles away from it, because the existence or persistence of these people is a *petitio principii*. The pragmatic argument also applies here. The hypothesis of persistency alone is workable in daily life: the opposite belief would quickly prove fatal to human society.

Our Knowledge of Objects

In answer to the question, What *do* we know of objects? let us take the following case.

A golden sovereign lies before me. After I have looked at it, felt it, and dropped it on the table, I say without hesitation that it is yellow, round, lustrous, cold, rougher in some parts than in others, and sonorous, because I hear a certain sound when it drops on the table. I allow the moonlight to fall upon the coin: it is much paler in colour, almost white. If I look at it by the light of the setting sun, it appears reddish. What is its real colour?

I said the sovereign was round, but if I view it from a certain angle it appears elliptical; and if I go a little way off, I see only a line. Which shape is the real one?

I said it was cold, but if I dip my fingers into ice-cold water and then touch it, it feels warm, and the colder my fingers the warmer the coin becomes. Is it really cold or warm? I said it was rough in parts, but after doing an afternoon's potting in the

greenhouse I cannot distinguish the rough parts.

Evidently the properties or qualities of the coin depend far more upon me than I ever imagined. In everyday life we attribute to objects the properties which we perceive under normal conditions, and with the aid of scientific hypotheses try to explain why the coin appears to change when the conditions external to it undergo modification.

But what are normal conditions ? And what right have we to say that the objects change ? Considerations such as these lead to the conclusion that the so-called properties of objects are not inherent in the objects themselves, and that they are merely sense-data, states of our own consciousness.

Primary and Secondary Qualities

But, it may be asked, do not objects possess some properties, such as solidity and extension, and motion, which are independent of us ? This is a problem which John Locke (1632–1704), one of the greatest of English philosophers, made peculiarly his own. In his famous " Essay concerning Human Understanding " (1690), he drew the distinction between the " primary " qualities of extension, motion, and solidity, and the " secondary " qualities of colours, sounds, tastes, etc., pointing out that the fundamental difference between them was that the former belonged to the objects—i.e. had an extra-mental existence, but the latter existed only in the mind of the observer, i.e. were purely subjective.

" The particular bulk, number, figure, and motion of the parts of fire and snow are really in them, whether any one's senses perceive them or not, and therefore they may be called real qualities, because they really exist in those bodies ; but light, heat, whiteness, or coldness are no more really in them than sickness or pain is in manna. Take away the sensation of them ; let not the eyes see light or colour, nor the ears hear sounds ; let the palate not taste, nor the nose smell ; and all colours, tastes, odours and sounds, as they are such particular ideas, vanish and cease, and are reduced to their causes, i.e. bulk, figure, and motion of parts."

" A piece of manna of sensible bulk is able to produce in us the idea of a round or square figure ; and, by being removed from one place to another, the idea of motion. This idea of motion represents it as it really is in the manna moving ; a circle and square are the same, whether in idea or existence, in the mind or in the manna ; and thus both motion and figure are really in the manna, whether we take notice of them or no : this everybody is ready to agree to."

Unfortunately, however, for the Lockean philosophy, everybody is *not* ready to agree to his distinction ; in fact, the consensus of opinion is altogether against his view, regarding primary no less than secondary qualities as not only *sensational* in origin but as *subjective* in character. Thus we should no more be able to explain extension to a man bereft of the senses of sight and touch and of the perception of motion, than we could explain the difference between red and blue to a blind man.

The evidence of physiology is also against the Lockean view. The student is referred to Huxley's *Bishop Berkeley on the Metaphysics of Sensation* (Collected Essays, Vol. VI.), where he will find the physiological arguments against the independent existence of primary qualities fully dealt with.

Suppose I cut my finger with a knife. The feeling of pain belongs to me, not to the steel. I am also conscious of the locality of the pain—I say it is in my finger. I am wrong : physiologists tell me that the pain is in my brain, for if blood-poisoning set in and my arm had to be amputated, I should experience exactly the same pain if certain nerve-ends of the stump were excited, and if I did not know what had happened, I should say that my finger was being cut again. Thus the localisation of the pain is an act of the mind, and locality or extension is no more a property of the knife than the pain. Similarly " motion " is a mode of distinguishing sense-data, i.e. it is conceptual, belongs to the mind.

Summary

We have an instinctive belief that an external or extra-mental world exists.

The belief that the events of waking life are more real than those of dream life is also instinctive, but it can be justified to some extent by reason.

Philosophers find it extremely difficult, if not impossible, to prove by logic that the extra-mental world is a reality. Arguments which seem to support it are (1) the fact that in sensation the messages come from without ; (2) the pragmatic view that the reality hypothesis is the only one which " works " in human life. Pragmatism also justifies the belief that objects exist when we are not observing them.

The qualities of objects (colours, sounds, hardnesses, etc.) are sense-data and purely mental.

Locke thought that the " primary " qualities inhere in the objects themselves ; this view is held to be untenable.

E. H. T.

Continued from page 18.

HISTORY:

Contributors:—J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.

FRANCE UNDER NAPOLEON

NAPOLEON BONAPARTE, whom the 18th Brumaire had made almost absolute master of France, was a Corsican of Italian descent. In his youth he was animated by a strong insular patriotism and dreamed of delivering Corsica from French domination; but as a young officer in the French army he came under the spell of the Revolution. Its democratic idealism appealed to his strongly imaginative nature, and its opportunities to his ambition.

Josephine de Beauharnais

During the period of unemployment which followed his services at Toulon he fell into a state of poverty and depression in which he lost much of his Jacobin idealism; but he studied hard and acquired a profound insight into history and the art of war. His minutes on the Italian campaign and his vigour on the 13th Vendémiaire brought him into notice and he obtained the hand of Josephine de Beauharnais, a fascinating young Creole widow for whom he had conceived a passion of southern intensity. Placed by the insight of Carnot at the head of the Army of Italy, his brilliant military and diplomatic successes, followed by the romance of the Egyptian expedition, dazzled the nation and inspired him with an almost mystical belief in his own destiny. He saw that France needed a strong man at the helm and he knew that he was capable of filling the post. In his eyes, the despotic powers given to the First Consul were but a reflex of the ties which united the greatness of France with his own career.

No two authorities are agreed as to his character. Historians are still debating as to whether he was a monster of ambition and cruelty or a martyr in the cause of liberty. Any attempt to render him consistent is probably a mistake. With all his magnificent intellectual power, the foundation of his character was imaginative and emotional. His views were based upon splendid flashes of insight rather than upon logical reasoning. He had the Southerner's temperament, swayed by fierce gusts of passion, yet capable of deep affection. His kindness to his family was almost doting; he was capable of splendid generosity and delicacy towards subordinates, and the extraordinary devotion with which he inspired his troops was won as much by his personal fascination as by the ascendancy of his genius.

Yet he was capable not merely of fierce acts of cruelty but of the mean and petty spite which led him to leave a substantial legacy to the attempted assassin of Wellington. His sentiments were humanitarian, and his administration shows a genuine interest in the welfare of the people. None the less, he shed blood with reckless profusion.

Napoleon's Character

In diplomacy he was a master of duplicity and no man ever excelled him in the fabrication of news and *bulletins*. His conversation and memoirs mingle astonishing powers of acting with outbursts of revealing frankness. He was often it may be suspected the dupe of his own powers of rhetoric.

His statesmanship was coloured by his vivid imagination. A master of political intrigue, and utterly without scruple in its use, he was nevertheless a visionary. His submission to the glamour of the East, the dream of erecting a great Oriental empire, which inspired his Egyptian campaigns, throws a flood of light on his character. His schemes for a regenerated France, for a remodelled Europe under French leadership, were grand and in many respects noble. Unhappily he lacked the judgment, or perhaps the fundamental sincerity of character which would have chastened his visions. With him, the grand too easily became the grandiose and with all his astonishing mastery of detail his essential egoism prevented him from recognising inevitable limitations.

Not only did he never understand the

working of sea-power but he never understood the character of British resistance. To the last he seems to have believed that the sympathies of the bulk of Englishmen were with him. While his rule was based on an appeal to the hearts and minds of the people and though he was never excelled in the art of appealing by sudden and splendid dramatic touches to the imagination of the masses he seems to have been as incapable as a Hapsburg of recognising the strength of nationality.

Against the organised national resistance of England, and the disorganised national resistance of Spain his power broke. More than this, by extending to Italians and Germans the principles of equality and freedom, on which the French Revolution was based, he awoke the germ of Italian and German national consciousness, yet he never saw that this national consciousness, which he had called into being, was fatal to his own dreams of domination.

Restoring Credit

As a soldier he was marked by the same imaginative power combined with astounding grasp of detail which characterised his statecraft and these qualities were reinforced by profound reading and reflection on the science of war. In sheer military skill, he has probably had equals, and at least one superior—Hannibal; but he has never been surpassed and perhaps never equalled in the vastness of his designs and the brilliance of his sudden inspirations.

Such was the man in whose hands the 18th Brumaire placed the destinies of France. We have seen with what renewed energy the Consulate carried on the war. Still more remarkable were its achievements in finance and administration.

One of its first tasks was to restore the public credit and create some sort of order out of the appalling financial chaos which had descended from the monarchy, and which had been increased rather than diminished under the Terror and the Directory.

Gaudin, an honest, experienced and able official, was appointed Minister of Finance and received the confidence and support of the First Consul. By consolidating the financial debt, by the presentation of clear and accurate budgets and by a judicious imposition of taxation he restored the financial balance in an astonishingly short period. In the budget of 1801-2 the receipts and payments practically balanced each other.

How lightly the new taxation bore upon the mass of the people is shown by Taine, who calculates that in 1789, out of every 100 francs of net income, the peasant paid 91 in taxes and dues. After 1800 he paid only 21.

The public functionaries under the Consulate were a very superior body of men, chosen for their ability alone, and they worked the machine of government with a regularity long unknown.

Conspiracies, whether Royalist or Jacobin, were put down with praiseworthy firmness, but not without a use of the police as spies and even as *agents provocateurs*. This, of course, opened the door to new abuses. The persecution of the Royalists was, however, closed by a general amnesty (1802). A Concordat with the Vatican (1802) once more legalised the position of the Catholics both in France and in the Italian Republic, while the Protestants also obtained full civil rights, liberty of worship and provision for their organisation and education. But the greatest work of the Consulate was the Civil Code.

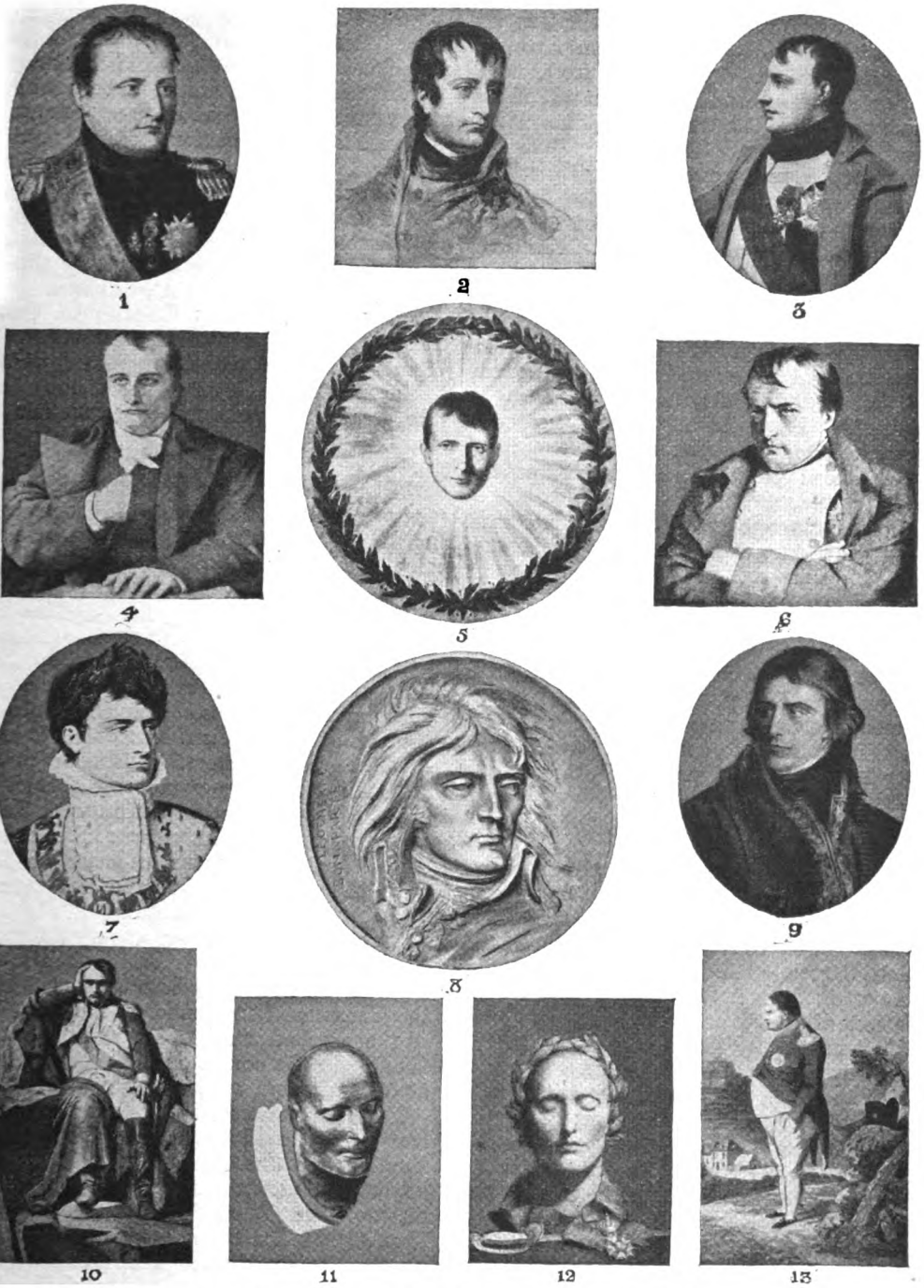
Even under the Monarchy there had been an aspiration towards the codification of French Law. Under the Convention and the Directory it had been attempted, but too hurriedly and in an atmosphere too charged with passion and change for success.

The Civil Code

It was reserved for the stronger and more stable government of the Consulate to carry out the task.

Bonaparte himself devoted his extraordinary powers of insight and political sagacity to its improvement. In some respects his influence was bad. He was only an amateur lawyer and the Code was marred by his impatience. Yet his breadth of vision, his humanitarian sympathies and his power of seeing how a law would work out in concrete fact and how it would affect the welfare of the state, were of immense service. Above all he provided the driving force which brought the Code into existence. On March 21, 1804, it passed into law and has remained ever since as part of the heritage of Frenchmen, combining the better principles of the old *régime* with what was most of solid worth in the achievements of the Revolution.

It is not surprising that services so splendid in the fields of economic and social reform, coupled with the halo of military glory, should have induced the nation to overlook the infringement of political liberties. In May, 1802, after the conclusion of the Treaty of Amiens a *plébiscite* was taken (somewhat illegally) on the question "Is Napoleon



WHAT WAS NAPOLEON REALLY LIKE?

1. *As shown on a snuff-box now in the British Museum;* ***2.*** *As painted by T. Phillips, R.A.;* ***3.*** *As sketched by Baron Gros in* 1796*;* ***4.*** *At St. Helena, from a painting by A. Monchablon;* ***5*** *and* ***6.*** *From portraits by J. L. David and Rumpf;* ***7.*** *From the miniature by C. Chatillon* (1805)*, in the possession of the Duke of Wellington;* ***8.*** *From the medallion by David D'Angers;* ***9.*** *As painted by Rumpf;* ***10.*** *Portrayed at St. Helena by Paul Delaroche;* ***11.*** *From the death mask in the Church of the Misericordia, Elba;* ***12.*** *From the death mask taken by Dr. Antommarchi;* ***13.*** *From a drawing made in* 1820 *by Colonel Dodgin of the* 66*th Regiment.*

Bonaparte to be made Consul for life ?" The answer was given in the affirmative by 3,568,885 votes to 8,374, and Bonaparte at once proceeded to draw up a fresh constitution which placed all power still more unreservedly in the hands of the First Consul.

In 1804, a real conspiracy with which Pichegru was connected, magnified by the police into a larger plot implicating Moreau roused the feeling of the nation. Pichegru was executed and Moreau (against whom there was no real evidence) was permitted to leave the country. The execution of the Duc d'Enghien, who was seized illegally in the territory of Baden and shot after a sham trial, left a dark stain on the character of Bonaparte. But real or sham the conspiracy had done its work and in November, 1804, a fresh *plébiscite* declared Napoleon hereditary Emperor.

We must now go back a year or two and take up the story of the Emperor's relations with foreign powers.

The Peace of Amiens was regarded by neither party as satisfactory or final. The commercial classes in England had desired peace in order to resume their trade with France ; but Bonaparte was in no way in advance of the extreme protectionism of his time. He refused to conclude a commercial treaty and continued practically to exclude British commerce from France.

War with England

Further, both the British government and the people were rendered uneasy by the continental policy of the First Consul. The annexation of Piedmont, the reduction of the Italian Republic, Holland and Switzerland to mere French protectorates, in flagrant violation of the Treaty of Lunéville, gave rise to protests by the British Government which were met by furious abuse.

In May, 1803, the war broke out afresh. Bonaparte at once formed a great camp at Boulogne and set about the preparation of a flotilla for the invasion of England. On the other hand the British Fleet blockaded the French ports and attacked the boats of the flotilla whenever they showed themselves beyond the range of the coast batteries.

In December, 1804, Spain, under the influence of Napoleon, as he must now be called, declared war against England, and a new plan of invasion was based on a combination of the French and Spanish fleets which were to elude the British squadrons and assemble in the Channel to cover the crossing.

In April, 1805, a treaty of alliance was signed between England and Russia. The Tsar Alexander had been an admirer of Napoleon, but he was horrified by the execution of the Duc d'Enghien, and his ministers represented to him that England was practically the sole market for Russian products. In May Napoleon assumed the title of King of Italy and annexed the Ligurian Republic, and shortly afterwards Parma and Piecenza to France.

Moved by these events and by the subsidies promised by Pitt, Austria joined Russia and England. The South German states formed an alliance with France. Prussia preferred to play a waiting game.

Meantime the French fleets had begun the great movement for concentration.

Battle of Trafalgar

Villeneuve with the Toulon Squadron got away to the West Indies, but Nelson was on his heels. The Brest Squadron was closely blockaded. In July, Villeneuve returned, but Barham had made an admirable disposition of the British fleets. The other French squadrons were masked. Villeneuve was brought to a partial action by Calder and put into Cadiz to refit. The great combination had failed and Napoleon threw up the idea of invasion and hurried off to attack Austria. On October 5 Villeneuve put out of Cadiz with the combined French and Spanish fleets to accept action with Nelson. The great British Admiral was killed, but not before he had inflicted a crushing defeat upon the Allies. It was the last time the French fleets offered battle.

On the land events moved very differently. *There* Napoleon was master of his craft. Casting his net wide he surrounded Mack, the Austrian Commander-in-Chief at Ulm, and compelled him to surrender (October, 1805). In the course of the short campaign 50,000 prisoners were captured.

Napoleon entered Vienna, and on December 2, he totally defeated the combined Russian and Austrian armies at Austerlitz, one of the tactical masterpieces of military history. On December 26 peace between France and Austria was concluded at Presburg. Venice, Istria and Dalmatia were ceded to the Kingdom of Italy, Tyrol and Vorarlberg to Bavaria, and Swabia was divided between Baden and Wurtemburg. The Electors of Bavaria and Wurtemburg were allowed to assume the title of King.

Meanwhile the tortuous policy of the Prussian Government was heading the State to disaster. Incensed by a violation of his

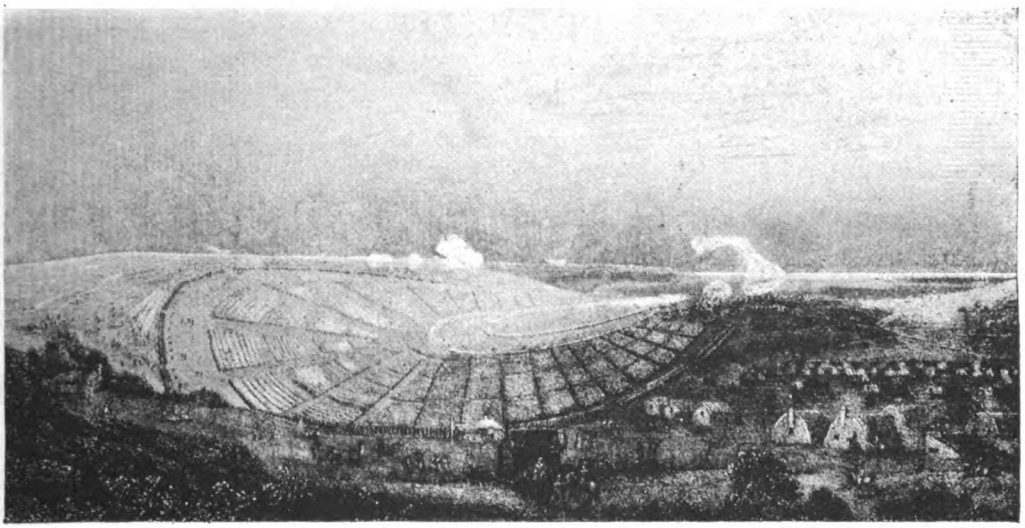
territory committed by French troops in marching through Ausbach, Frederick William III. concluded a Convention with Russia on November 3, 1805, but after Austerlitz he withdrew from his engagements and entered into an alliance with Napoleon. Prussia was to annex Hanover and close the North German ports to British commerce. The British promptly blockaded the Prussian coast.

In February, 1806, the French troops entered Naples, which had joined Austria, and in March Joseph Bonaparte, the brother of Napoleon, became King of the Two Sicilies. In June Louis Bonaparte became King of Holland. In July Napoleon united Bavaria, Wurtemburg, Baden and the minor Western States of Germany in the Confederation of the Rhine under French Protectorship and the Holy Roman Empire, which had long been little more than a diplomatic fiction, came to an end.

At this time Napoleon was negotiating for peace with England, where Fox had succeeded Pitt, who died soon after receiving the news of Austerlitz, but no agreement was reached. As part of the terms Napoleon offered the restoration of Hanover, and the King of Prussia, violently incensed, declared war on France. Saxony joined with Prussia, which was now to reap the reward of her policy, in standing alone against Napoleon. The Prussian Army was full of confidence, but it was petrified by tradition and inefficiently commanded. On October 14, while Davout, perhaps the ablest of Napoleon's marshals, defeated Brunswick with a greatly superior force at Auerstadt, the Emperor himself crushed the Hohenlohe at Jena. The Prussian army was broken to pieces. Saxony was detached and entered the Confederation of the Rhine.

Napoleon pushed through Prussia, and reinforced by the contingents of the German states, attacked the Russians. On February 7, 1807, he fought a drawn battle with Benningsen at Preussich-Eylau, on June 14, 1807, and defeated him decisively at Friedland. On June 25, a personal interview between Napoleon and the Tsar took place on a raft moored in the Niemen, and on July 7 the Treaty of Tilsit was signed between the two powers. Two days later followed the treaty of peace with Prussia.

All Prussian territory West of the Elbe was taken from Frederick Wilhelm and, together with Hesse, was erected into the Kingdom of Westphalia for Napoleon's brother Jerome. The Polish provinces became the Duchy of Warsaw under the King of Saxony and Danzig became a free city. A large French Army of occupation was to remain in Prussia until all war contributions had been paid. These arrangements were recognised by the Tsar, who also ceded the Ionian Isles to France. It was understood that he should be left to indemnify himself at the expense of Sweden and Turkey.



From the picture by Gautier.

NAPOLEON'S CAMP AT BOULOGNE,

where in 1804 was assembled an army of 160,000 men with 10,000 horses for the invasion of Britain.

After the final defeat of Trafalgar, Napoleon had abandoned the idea of invading Britain, and he conceived the idea of ruining these islands by excluding British trade from the Continent. On November 21, 1806, he had issued the Berlin Decree declaring the British Isles to be in a State of Blockade and all British merchandise to be liable to seizure. To this Paper Blockade the British Government replied by an Order in Council prohibiting all commerce between ports from which British ships were excluded. On December 17, 1807, Napoleon issued the Milan Decree constituting every ship of any nation sailing from a British port or submitting to search by British cruisers, good prize.

The weakness of Napoleon's position lay in his lack of naval power to enforce the Decrees. The British fleet could and did cut off trade with France, but the French cruisers were unable to inflict more than a certain percentage of loss, and the effort to stop British trade by the occupation of Continental territory simply led to a gigantic system of smuggling, which raised the price of imports without ruining British merchants.

Affairs in Spain

In 1807, Napoleon had entered into the Treaty of Fontainebleau with Spain for the partition of Portugal, and a French Army under Junot occupied Lisbon. In 1808, he took advantage of dissension in the Spanish royal family to interfere in Spanish affairs and moved troops across the Pyrenees. Charles IV. having been induced to abdicate, Joseph Bonaparte was declared King of Spain.

The Spanish people, though abominably governed by the Bourbons, were fiercely excited by the French invasion and the duplicity of Napoleon's diplomacy. A general insurrection broke out.

During the winter (1808-9) Napoleon invaded Spain, broke the Spanish armies to pieces and entered Madrid. He was sweeping on to Portugal and the south, when Sir John Moore with a British force cut across his line of communications. Napoleon swung round his whole power upon him, but Moore, having gained a respite for Spain, eluded him, and Napoleon, hearing that Austria's attitude was threatening, returned to France. Soult, who continued the pursuit, was repulsed at Corunna, and the British embarked, Moore falling in the moment of victory.

The Austrian government hoped to take advantage of the Emperor's preoccupations to regain their old position in Europe. England promised large subsidies, and in April, 1809, the Austrian army took the field.

The Archduke Charles, who was an enlightened man as well as an able general, had effected many reforms in the army and had aroused a genuine patriotism in the troops; but the resources of Austria were very inferior to those of Napoleon, who had at his command not only France but the Kingdoms of Italy and Westphalia and the Confederation of the Rhine.

On April 22, he defeated the Archduke at Eckmühl. On May 12 he entered Vienna. On the 21st and 22nd of the same month, however, his attempt to cross the Danube was defeated in the great battle of Aspern or Essling. After being reinforced, he again crossed and defeated the Archduke (thanks chiefly to the blundering of his brother the Archduke John) in a very hard fought battle at Wagram.

Napoleon's Coronation

In the meantime the Russians had defeated the Austrians in Poland, an English expedition to Flanders had failed dismally in the swamps of Walcheren and several risings in Germany had been put down. The Tyrolese, under Hofer, animated by a splendid patriotism, had defeated Napoleon's Bavarian allies, but after Wagram they were crushed by sheer weight of numbers and Hofer was cruelly shot.

On October 14, 1809, peace between France and Austria was signed at Schönbrunn, Austria suffering still further losses of territory.

Despite these notes of warning and the still more serious results which were to flow from the Spanish entanglement, the year 1809 witnessed the extension of Napoleon's Empire to its furthest limits, and before tracing further the operation of the causes which led to his downfall we must turn for a while to consider the internal condition of France and her protectorates under his rule.

The Coronation of Napoleon as Emperor hardly added anything to his real power. As Consul for life he had been in fact absolute ruler of France, and his ascendancy over the other elements of the Constitution was so great that the gradual lopping of their powers under the Empire made little difference to the real working of the government. But while the constitutional results of the change were small its effects upon the mind and policy of Napoleon were of great importance. His imagination was fired with the hope of establishing a dynasty, and both his domestic and foreign policy became domin-

From the painting by Gosse.

AT TILSIT (JULY, 1807).

The famous meeting between Napoleon and Louisa, the proud and beautiful Queen of Prussia, who came to plead with the upstart Emperor for concessions in the terms of the harsh peace which he had imposed on her country.

ated by his conception of the greatness of the Imperial House.

In foreign affairs the new spirit showed itself in his adoption of a dynastic policy, his desire to plant his brothers and sisters on the thrones of minor states closely related to France, his proposals to the Tsar for the formation of a political system dominated by the two great Imperial Thrones.

Imperial State

At home, he set himself to create support for the Crown by the creation of a new nobility. A whole hierarchy of great officials, the Arch-Chancellor of the Empire, the Constable, the Grand Admiral, the Grand Chamberlain, the Grand Master of the Ceremonies, enabled him to reward good service and added to the splendour of the Court. A new hereditary nobility was created for the Grand Dignitaries, the Marshals and other officials. Great fiefs were carved out of the conquered territories to supply titles and revenues for the new nobles. Others received princely grants or estates within the Empire. Members of the old nobility were attracted by appointments about the Household. The Court, led by Josephine, was splendid and extravagant.

Napoleon himself abandoned the Spartan simplicity and energy of his earlier years and developed a taste for ease and good living. Art and architecture were encouraged and their grandiose magnificence, unchastened by correct taste, reflected the inspiration of the central figure. But all this display rested on insecure foundations. The old nobility despised their *parvenu* surroundings, the new nobility quickly became sated and indolent. Luxury sapped the energy of the Marshals. The splendour and the strict etiquette of the Court cut off Napoleon more and more from the people in whose devotion his power had been based.

Nevertheless much of the good work of the Consulate went on. If Napoleon was an illiberal statesman, he was an incomparable administrator. Great public works, roads, canals, bridges were pushed forward with energy and laid France to this day under a heavy debt of gratitude. Agriculture and industry were encouraged and material prosperity was widespread.

Under the Empire a number of great names, notably, Cuvier, Lamarck, Laplace and Arago, appear in natural science and astronomy, and science was successfully applied to the aid of industry. Education was organised with a view to State Control and the University of France was founded in 1808. The Civil Code was followed by the Code of Civil Procedure (1806), the Commercial Code (1807), the Code of Criminal Procedure (1808), and finally the Penal Code (1810).

The Commercial Code was hurried and defective, and the Penal Code was marked by the harshness of despotism ; but taking them in the mass the Five Codes represented an inestimable gift to France and their introduction into the subject districts of Germany and Italy did more than anything else to create the new spirit of liberty and good government.

The vassal states, whether annexed or nominally independent, shared in the general good administration of the Empire. Napoleon's brother, Joseph, as King of the Two Sicilies, his stepson Eugene Beauharnais as Regent of the Kingdom of Italy, governed with real consideration for their subjects, and even the *beau sabreur*, Murat, who succeeded Joseph on his transference to Spain, proved a kindly and popular ruler. Tuscany, on the other hand, gained little by incorporation in the Empire and fiercely resented the conscription, while the annexation of the Papal States in 1807 was offensive both to Catholics and to Italian feeling.

Outraged Nationalities

The Kingdom of Westphalia was less fortunate than Lombardy or Naples. Jerome Bonaparte though amiable was careless and extravagant, and the demands of Napoleon for men and money constituted a crushing drain upon the people. Of the German Provinces which were directly incorporated in France, those on the Rhine which had been annexed under the Revolution, profited greatly by the abolition of the old petty governments and were content and prosperous under French rule, but the Hanseatic towns suffered cruelly from the Continental System and bitterly resented the loss of their ancient liberties.

Holland, as we have seen, was well administered under Louis, but after annexation to France the country was subjected to crushing taxation and a systematic campaign of denationalisation, while the Belgian provinces were bitterly offended by the religious policy of the Emperor and the rigid conscription.

While still First Consul Napoleon had aimed at making France a great colonial power. The failure of the French navy, however, put an end to any effective colonial policy.

J. B. S-B.

Continued from page 35.

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***Contributors*:**—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).

BOTANY.—XXI

DICOTYLEDONS—POLYPETALÆ (*continued*)

59. Leguminosæ (*Pea family*).—This is a very large and valuable family of plants, which includes herbs, shrubs and trees. The British native species are all herbs; but one or two trees—notably the Laburnum and Acacia—are often seen in cultivation. The common feature of the order is the fruit, which is a *legume*: most of the species, and all the British ones, have papilionaceous flowers. This term is given to such corollas as those of the pea, vetch, clover, laburnum, etc., in which there are five petals; the posterior one is very much larger than either of the others, and forms a large and conspicuous canopy for the rest of the flower. It is known as the *standard* petal. The two anterior petals are joined together to form a boat-shaped structure, the *keel*, which completely encloses the stamens and carpel.

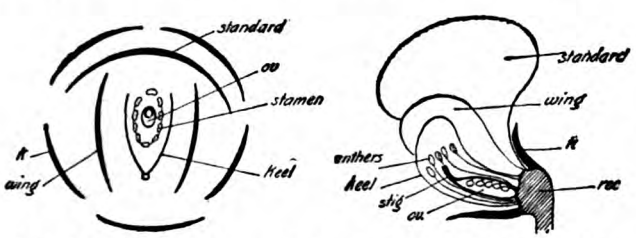


Fig. 152.—Floral plan and a long section of Leguminosæ.

The two remaining petals form the *wings* and act as a lateral protection and support. The corolla is attached to the lower edge of the calyx, where it joins the receptacle. The stamens are ten in number, and in most of the genera nine of them are united by the filaments, leaving the upper or posterior one free (*diadelphous* arrangement): in gorse, broom and rest-harrow they are all united (*monadelphous*).

The flowers of this family are in general admirably adapted for insect-pollination, especially by bees. The general method is for the bee to alight on the keel; the wings then fly apart, and the weight of the insect depresses the keel, which gives way suddenly so that the stamens and stigma strikes the insect forcibly on its underside. There is much variation in details, however, and the behaviour of a bee in the flowers of a scarlet runner, a vetch, gorse and clover should be carefully compared. On some occasions the flower does not recover itself after the insect's visit, e.g. gorse; others the insect can visit several times. The shape of the keel varies very much from the spiral one of the scarlet runner to the smaller but relatively deeper one of red clover. Moreover, it is very instructive to observe the different ways in which the pollen is liberated, and to note how in the annual species provision is also made for self-pollination. Indeed the sweet pea is often, if not always, pollinated before it opens.

Fig. 153.—Rest Harrow (*Ononis*).

The commonest genera are: *Lathyrus* (Pea); *Vicia* (Vetch); *Ulex* (Gorse); *Cytisus* (Broom); *Trifolium* (Clover); *Medicago*

(Medick, Lucerne); *Ononis* (Rest Harrow); *Lotus* (Bird's Foot Trefoil); *Onobrychis* (Sainfoin). Of these the clovers, lucerne, tare (vetch) and sainfoin are commonly cultivated as fodder plants. Many of these genera have numerous species; and all of them have some interesting features of structure which make them worthy of very careful examination.

60. Rosaceæ (*Rose family*).—We have in this large and varied order, containing

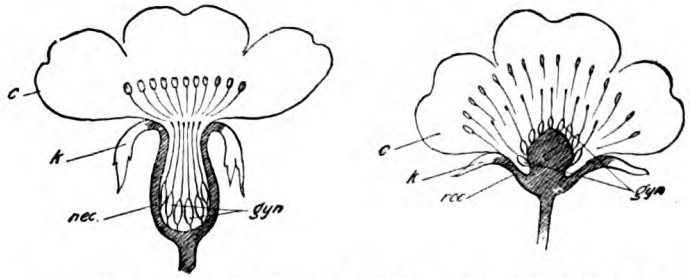


Fig. 154.—Flowers of Rosaceæ :—(left) rose type : epigynous ; (right) silverweed type : perigynous.

something like 1,000 species, flowers of the actinomorphic type with, usually, five sepals; five petals; many stamens, and a gynœcium having a variable number of apocarpous carpels. The fruits vary widely—drupes, achenes, follicles and pseudocarps occurring in different genera. They differ from the Ranunculaceæ in their compound stipulate leaves and in the enlargement of the receptacle which grows up round the rest of the flower in the form of a kind of hollow cup. This makes the floral parts perigynous or epigynous, according to the extent of this receptacular growth (Fig. 154). The hollow receptacle is sometimes wrongly described as the calyx-tube, as if it were formed by a union of the sepals; but the junction of the sepals with the tube can easily be seen. In some cases (Rose, Apple) the receptacle almost encloses the carpels entirely; in others, the carpels are mounted on a sort of cone, and the flower remains an open one (Bramble, Silverweed).

Pollination in the Rosaceæ is usually by insects; nectar is usually formed on the receptacle-tube, and is easy to find. The flowers of hawthorn and blackthorn are to some extent protogynous; others are slightly protandrous; but self-pollination is possible in most, and even flies may pollinate the majority. The Wild Rose and Meadowsweet are pollen-flowers, producing no nectar. The Salad Burnet, a common weed of chalky pastures, has very small flowers, aggregated into heads, which have all the characteristics of wind-pollinated flowers. The individual flowers are often unisexual, or strongly protogynous.

The common genera are not difficult to identify. *Prunus* (Sloe, Plum, Cherry, Almond) has one carpel only which forms a drupe and none of the receptacle takes part in the fruit. In *Pyrus* (Pear, Apple), on the other hand, the receptacle completely encloses the true fruit and forms a pseudocarp. *Pyrus Aucuparia* is the Mountain Ash or Rowantree, no relative of the true ash; its so-called berries are also pseudocarps. *Crategus* (Hawthorn) resembles Pyrus in its fruit, except that the carpels are one-seeded and have a stony pericarp. The "hip" of *Rosa* is also essentially the same, but the numerous achenes remain quite free.

The receptacle remains, but does not enclose the fruit in several common genera. In *Rubus* (Bramble, Blackberry) the fruits are drupes on a hard conical receptacle. *Fragaria* (Strawberry) has a swollen receptacle with small achenes embedded in it. A collection of achenes on a dry receptacle is found in *Geum* (Wood Avens); and *Potentilla* (Silverweed, Cinquefoil, Tormentil). Follicles are found in *Spiræa* (Meadowsweet). In most cases the calyx is persistent (but not in *Prunus*); in some (*Potentilla*, *Geum*) an epicalyx or extra whorl of sepals is also present. A dry receptacle enclosing the achenes is found in *Poterium* (Burnet); *Agrimonia* (Agrimony) and *Alchemilla* (Lady's Mantle) (Fig. 155).

Fig. 155.—Agrimony.

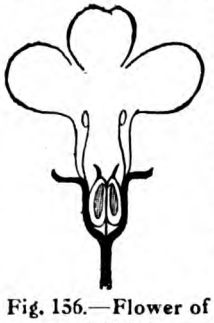


Fig. 156.—Flower of Umbelliferæ.

61. Umbelliferæ (*Parsnip family*).—In the mass this order is one of the easiest of all to distinguish, but its very numerous genera and species provide a very difficult problem, involving the observation of very nice points, for their complete identifica-

tion. The plants of the order are usually large herbs with hollow stems, branching at sharp angles, and often with much divided leaves. The characteristic features, however, are the conspicuous umbels or compound umbels, and the fruit, which may differ in shape but remains constant in type throughout.

The individual flowers are small, with K5, C5, A5, G[2] as their floral formula. The outer flowers of an umbel are often zygomorphic and lacking in the androecium. The nectar is formed in a fleshy disc on the top of the ovary, and pollination is quite easy even for short-tongued insects (Fig. 156).

The fruit is a *cremocarp*, i.e. a schizocarp with two carpels, which remain lightly attached to a carpophore after separation (Fig. 157). The separate fruits are of various shapes and sizes; flattened and very light, as in parsnip; elongated and rounded, as in caraway; small and hairy, as in hedge-

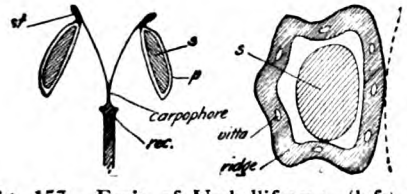


Fig. 157.—Fruit of Umbelliferæ :—(left) the cremocarp; (right) one carpel in cross section.

parsley; and so on. It generally shows five pronounced longitudinal ridges externally; and, if it is cut transversely, and examined with a lens, little holes will be noticed in the pericarp between the ridges. These are the *vittæ*, glands which secrete a fragrant oil. Each carpel has one seed, which is usually endospermic.

Included in this order are numerous useful plants, such as parsnip, carrot, parsley, fennel, chervil, samphire, earth-nut, celery, caraway, coriander, etc. Fool's parsley, water dropwort and hemlock are very poisonous. Among the numerous common species found in hedges, ditches or meadows are cow-parsnip, hogweed, angelica, hedge-parsley, burnet saxifrage, shepherd's needle, sanicle, marsh pennywort. The two latter have simple umbels; the sanicle is a common flower in woodlands, and the pennywort in bogs.

62. The three orders just described have one point in common: their corolla and stamens arise either on the calyx or on a so-called calyx-tube. The following orders, of rather less abundance and importance, also have this feature; they contain a number of species which ought not to be overlooked.

Onagraceæ (*Willow-herb family*). K4, C4, A8, G[4] is the usual floral formula, as seen in the willow-herbs. The rose-bay willow-herb is a large herb with handsome red flowers, lanceolate leaves, and a long pad-like capsule producing an abundance of hairy seeds. The Evening Primrose, Fuchsia and Godetia are cultivated examples of the order. The Enchanter's Nightshade is common in woods; it has large leaves but very small white flowers with all the parts in twos.

Lythraceæ contains the large purple loosestrife, a common weed on waste ground. It has trimorphic flowers; i.e. flowers of three kinds in which the two whorls of stamens and the stigma stand at three different levels.

Fig. 158.—Purple Loosestrife.

Saxifragaceæ : an order chiefly belonging to high altitudes and rocky ground. K5, C5, A5–10, G2. The styles are free and stand out in opposite directions. The various saxifrages are all alpine plants; London Pride is a common plant in rock-gardens; and the golden saxifrage is a pleasant little marsh-plant, with no petals and yellowish sepals. The Grass of Parnassus, a native of boggy land in high altitudes, is a beautiful plant with white flowers delicately streaked with green.

Crassulaceæ : an order whose members are chiefly adapted to dry situations, from sandy deserts to bare mountains and moors. The common stonecrops are small moss-like plants with small fleshy leaves and comparatively conspicuous white or yellow flowers. The houseleeks, with their rosettes of pale green leaves, are familiar ornamental plants in gardens.

DICOTYLEDONS—GAMOPETALÆ

63. Compositæ (*Daisy family*). — This is the largest order in the whole flora and has about 10,000 species, which are widely distributed all over the globe in all kinds of habitat. The aggressive habit of the Compositæ depends on three general factors: the tenacity with which most of them hold the soil; the nature of the inflorescence; and the provision of an efficient arrangement for seed dispersal.

The British Compositæ are all herbaceous, but tending to become woody perennials in some cases. Their leaf-arrangements are

in general admirably adapted to their habits (e.g. daisy, dandelion, groundsel, etc.); their roots or rhizomes make them often the most troublesome weeds. Many of them have bitter juices in their hollow stems, which makes them disagreeable to animals.

The inflorescence is a head, and this can

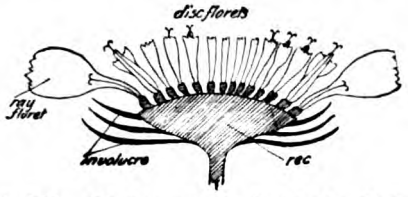


Fig. 159.—Diagram of the head of a Daisy.

be comfortably studied in the sunflower or daisy. In these examples, the head is seen to be composed of three parts: the disk; the rays; and the whorl (or several spiral turns) of green, often rough, bracts—called *involucre*—beneath the head (Fig. 159). The *disk* is seen to be made up of a compact mass of small flowers; each of these has a deep gamopetalous corolla with five teeth, five stamens whose anthers form a continuous ring round the style, and an inferior ovary with a long style and two stigmas. The ovary is unilocular, and has one ovule arising from its base. In the daisy there is no calyx, but in many genera the ovary is surmounted by a ring of hairs which may be supposed to be reduced sepals. Thus the floral formula of the disk florets is KO, C[5], A[5], G[2]. The *ray* florets are quite different. In the daisy they are wanting

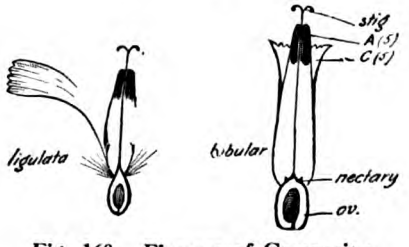


Fig. 160.—Flowers of Compositæ.

in stamens, but the gynæcium is present and like that of the disk florets. The corolla, however, is the shape called *ligulate*. It does not form a tube, but grows out flat, as if it were a single petal. A few teeth are seen in some genera to indicate its compound nature; but it has usually the appearance and effect of one petal only, and does not make a tube until quite close to its insertion on the ovary (Fig. 160). The presence of these attractive ray-flowers, together with the compact mass of the disk flowers make the head a very effective pollinating agent. And as very few of the florets are open at the same time, the probability is that cross-pollination will occur. The individual florets, too, are to some extent protandrous: the anthers can be seen peering above the tubular corolla, before the stigma is visible. Later the style elongates and the stigma appears a little way beyond the anthers (Fig. 160).

The nectar is produced at the base of the style and accumulates in the narrow corolla-tube. Any insect almost can reach it. The pollen being discharged near the mouth of the tube is readily removed, even if the insect does not seek the nectar. Much of it adheres to the style, and can be seen there when the stigma has emerged. If cross-pollination does not occur, the stigma coils backward and picks up this pollen. The pollinating arrangements are therefore exceptionally complete, and a large number of seeds are formed on each head. Many Compositæ have ligulate flowers only; a few others have tubular ones only.

Fig. 161.—Teasel.

1. Among the Compositæ which have tubular and ligulate flowers are:—*Bellis* (Daisy); *Helianthus* (Sunflower); *Dahlia*; *Aster*; *Achillea* (Yarrow); *Anthemis* (Corn Camomile, Mayweed); *Matricaria* (Scentless Mayweed); *Senecio* (Ragwort: but Groundsel has no ligulate flowers); *Cineraria*; *Chrysanthemum*.

2. Among those with ligulate flowers only are: *Taraxacum* (Dandelion); *Lapsana* (Nipplewort); *Lactuca* (Lettuce); *Hieracium* (Hawkweed); *Crepis* (Hawksbeard); *Cichorium* (Chicory—with blue heads); *Sonchus* (Sow Thistle); *Leontodon*.

3. Among those with tubular flowers only we may mention *Carduus* (Thistle); *Arctium* (Burdock); *Centaurea* (Knapweed, Cornflower); *Filago* (Cudweed); *Petasites* (Butterbur).

The **Dipsaceæ**, including the Teasel (Fig. 161), is the only order likely to be confounded with Compositæ. The flowers are in heads, but the anthers are not united and there is only one stigma.

E. W. E.

GEOLOGY.—VIII

Saline Residues:—Chemically formed beds of rock salt and gypsum are sometimes found interbanded with detrital sediments like mails, clays and sands. The composition of sea water and of the waters of inland lakes and seas is such that if the water were evaporated the substances in solution would, in turn according to their solubility, reach the point of saturation and be precipitated. The least soluble would naturally be precipitated first and the most soluble would remain till last. A certain order of crystallisation is therefore followed, dependent on the composition of the original water and its temperature. The usual order observed is as follows:—

(1) Ferric hydrates, such as limonite.

(2) The carbonates of calcium and magnesium giving dolomites and magnesian limestones.

(3) Gypsum $CaSO_4.2H_2O$ and Anhydrite $CaSO_4$. The latter is only precipitated in cases where the temperature exceeds 25° C. Gypsum is represented in a pure massive form by *Alabaster*.

(4) Rock Salt, which begins to precipitate soon after gypsum and continues to the end of the evaporation. The solubility of salt increases with temperature, while that of gypsum decreases, so that under well balanced conditions, rock salt will be precipitated during the winter and gypsum during the summer.

(5) The chlorides and sulphates of potassium and magnesium are the last products of evaporation, and since geographical conditions can rarely have favoured the complete desiccation of a large salt lake, such deposits are few in number. Those of Stassfurt, from which most of the commercial salts of potassium are obtained, are by far the most important.

The geographical conditions which lead to chemical precipitates of the above kinds are illustrated at the present day by the Dead Sea, which deposits gypsum and rock salt, by the Great Salt Lake of the American Cordillera, and by the barred-off Gulf of Kara Boghez on the east of the Caspian. In all cases evaporation exceeds the supply of fresh water from rain or rivers. The presence of saline residues in the older sedimentary rocks therefore points to arid conditions and to the concentration of the waters of barred-off seas or inland lakes.

In the British Isles the Trias rocks contain beds of gypsum and rock salt, e.g. at Middlesbrough, Droitwich and other localities in Worcestershire and Cheshire, and at Carrickfergus near Belfast. The mails, clays and sandstones accompanying these deposits are generally stained a deep red owing to the precipitation of ferric hydrates amongst them. Fossils are very scarce and are stunted and dwarfed since strongly salt water is unfavourable to organisms.

Calcareous and Siliceous Deposits.—Waters laden with $CaCO_3$ (and $MgCO_3$) in solution can only continue to hold these substances while they also carry carbon dioxide. On coming into contact with the open air, CO_2 is lost and the carbonates are deposited. Dolomite and Magnesium limestones are thus sometimes formed in lakes, the precipitation being helped by evaporation and by the presence of Na_2CO_3. Around springs of calcareous waters, soft spongy or concretionary deposits gradually accumulate, to which the names *travertine* or calcareous *tufa* or *sinter* are applied. These become hard and crystalline throughout by later cementation with $CaCO_3$. The Auvergne, the Yellowstone Park, and the Tivoli near Rome, are localities in which travertine is now being formed. The stalactites and stalagmites of limestone caverns (e.g., Ingleborough and Cheddar) are formed in essentially the same way as travertine.

The thermal waters of expiring volcanic regions frequently carry silica in solution as alkaline silicates. On coming into contact with the air the silica is deposited and sheets and terraces of *siliceous sinter* are built up. The volcanic regions of North Island, New Zealand, Iceland, and Yellowstone Park supply famous examples.

Abyssal or Pelagic Deposits:—In the deep sea beyond the reach of terrigenous sediment, the only materials which can accumulate on the ocean floor are the hard remains of calcareous organisms such as foraminifera and pteropods, of siliceous organisms such as radiolarians, diatoms and sponges, and of volcanic dust carried by the wind from volcanoes and meteoritic dust formed from the combustion of meteorites. Since the solution of SO_2 and $CaCO_3$ increases with pressure, sheets made of these substances slowly dissolve as they fall to the bottom. The calcareous shells, however, dissolve more rapidly and are found in decreasing quantities as the depth of the ocean floor increases, until at 3,000 fathoms they practically disappear. Siliceous shells are less soluble and persist down to the greatest depths.

Over parts of the ocean floor, organic remains of the kinds mentioned are very scarce, either because they have been dissolved as they fell from near the surface or because the surface waters are free from them. The deposit then formed on the ocean floor is known as the *Red Clay*. It contains ferruginous clay, minerals, volcanic and meteoritic dust, grains and nodules of manganese peroxide, zeolites, and fossil remains like shark's teeth and the earbones of whales. As the calcareous and siliceous organisms increase in number, the red clay merges laterally into the various oozes, as shown here diagrammatically :—

Radiolarian Ooze — Globigerina Ooze
Red Clay
Diatom Ooze — Pteropod Ooze

Globigerina Ooze is the most widely distributed, and is specially characteristic of the Atlantic and of the western half of the Indian Ocean. It is buff or grey in colour and is made up almost entirely of foraminiferal shells of which globigerina is the chief, pteropod shells and the remains of calcareous algæ.

Pteropod Ooze is only a variety of globigerina ooze rich in pteropod remains. It occurs along the central ridge of the Atlantic and around coral reefs in the Pacific.

Radiolarian Ooze is a variety of red clay rich in radiolarian remains. It occurs at great depths in the tropical belts of the Pacific and Indian Oceans.

Diatom Ooze is the accumulated remains of minute siliceous plants—diatoms—and is found in a narrow belt surrounding Antarctica and in a smaller belt along the extreme north of the Pacific.

Limestones :—In addition to the calcareous organisms mentioned above, the limestone building shells are chiefly those of corals, echinoderms (crinoids, sea urchins, etc.), brachiopods, lamellibranchs and gasteropods. The Pre-Cambrian limestones are free from calcareous fossils and it has therefore been suggested by Daly that in the early ages of the earth's history, the ocean was too poor in $CaCO_3$ to enable the soft-bodied organisms (presumed to have then lived) to form hard shells. As a result of the decay of organisms, ammonium carbonate would be formed, as it now is in the Black Sea, and this would precipitate as carbonates all the calcium and magnesium carried by the rivers from the lands. The oldest limestones are therefore not considered as fossiliferous accumulations, but as chemical precipitates formed by organic intervention. After a time scavenging organisms were evolved which cleared away the decaying matter and allowed the calcium to accumulate to such an extent that shell forming animals became possible. The later limestones, from the Cambrian onwards, are in accordance with this view richly fossiliferous.

Chalk is a pure white friable limestone mainly composed of foraminifera like the globigerina ooze of the present day. It is not, however, a deep sea deposit, but was formed in clear waters of moderate depth from which sandy and muddy sediments were absent. The Eocene limestone of which the Pyramids are built is rich in the remains of Nummulites (Vol. V., p. 253).

Coral limestones, represented in this country by the Wenlock, Devonian and carboniferous limestones, consist largely of the remains, broken and intact, of reef building corals. The Wenlock and carboniferous limestones are also in places made up almost entirely of *crinoid* stems and plates. *Shelly* limestones result from the consolidation of shell sands by calcareous or ferruginous cements. The Red Crag is made up of marine shells, and other tertiary limestones are rich in the remains of fresh water and land types of molluscs.

Many of the Jurassic and carboniferous limestones are *oolitic*, that is, they are composed of rounded grains like the roe of a fish. The term roe-stone, or oolite, is therefore given to them. When oolite grains are examined under the microscope they are found to have a central nucleus—a bit of shell or sand—around which successive coatings of calcium carbonate have clearly been deposited. They are, in fact, concretionary structures, and they may be developed in shallow tidal waters where they are rolled about and alternately wetted with calcareous solutions and dried. They may also be formed by organic agencies, for they are frequently associated with calcareous algæ. The oolites are as big as or bigger than peas ; the name *Pisolite* is given to the rock.

Argillaceous or clay bearing limestones are valuable as natural (hydraulic) cements, for when they are calcined and crushed, the resulting powder is able to " set " under water.

Magnesian Limestone and Dolomite Limestones, particularly the older examples, always contain some $MgCO_3$. In Pre-Cambrian times it is probable that this constituent was directly precipitated along with the more abundant $CaCO_3$. The shells of living organisms always have a little

$MgCO_3$, though the percentage is generally very small. However, both land waters and ocean waters begin to dissolve away the shells, and $CaCO_3$ is removed much more readily than $MgCO_3$ which therefore begins to be more abundant in the undissolved remains.

Moreover, from warm inland seas $MgCO_3$ may be directly precipitated if the waters are sufficiently concentrated. Limestones which have been enriched in $MgCO_3$ either by leaching or precipitation are called magnesian or dolomitic limestones. When the two carbonates are present in equal molecular quantities, $CaMg(CO_3)_2$, the rock is called a *Dolomite*. Dolomites formed by precipitation are generally associated with gypsum. The Magnesian Limestone of the Permian of Durham is a notable example. Coral limestones are particularly prone to dolomitisation by leaching, for corals are made up of aragonite, a form of $CaCO_3$ more readily replaced or removed than calcite.

Ironstones and Iron Ores:—All natural waters contain iron in solution—generally as the bicarbonate, but also as the sulphate (formed by the oxidation of pyrites). When such solutions come into contact with limestone, the latter is replaced by chalybeate, molecule by molecule, the limestone going into solution as bicarbonate of calcium.

The important ironstones, for example, of Rosedale and Cleveland in Yorkshire and others in Northamptonshire and Lincolnshire have been formed in this way, for all the oolitic and fossil structures have been perfectly preserved in the new medium. By later surface oxidation and hydration, hæmatite amd limonite sometimes take the place of chalybeate.

In the coal measures ironstones mixed with clay are known as *clay* ironstones and *black band ironstones*. Many of these were probably directly deposited without the intermediary deposition of calcareous matter. Where vegetation is decaying, oxidation of the ferrous solutions cannot take place, and since much carbon dioxide is evolved, any ferrous carbonate tends to be kept in solution. However, when other organisms (bacteria) are present which remove the excess carbon dioxide, ironstone may be precipitated.

In lakes and marshes, where vegetation is *living*, oxygen is given off and ferrous solutions are oxidised with the result that limonite is deposited. Limonite is a fibrous submetallic mineral, silky to the touch, variously shaded brown or yellow. Its chemical formula is $H_6Fe_4O_9$. In this way the *lake iron-ores* of Sweden and the *bog iron-ores* of the coal measures are produced.

Chert and Flint:—In many limestones sheets and lens-shaped bands have been replaced by silica in the form of chalcedony. Such rocks are called *cherts*. They are usually found to retain the structures of the original formation like the ironstones described above. Silica in a somewhat soluble form is present in all limestones as the tiny shells of radiolarians and diatoms and also as the spicules of sponges.

Where these are not very abundant they easily pass into solution in waters percolating through the rocks. When the waters come in contact with a bed richly endowed with siliceous remains they rapidly become saturated in respect of silica and the calcareous matrix is replaced by chalcedony, which is much less soluble than the original organic form of silica. Thus beds of chert arise. The Lower and Upper Greensands around the Weald provide excellent examples.

Flint is essentially similar in its origin. It occurs in the chalk in black or grey nodules and thin beds and generally encloses sponge spicules in large quantities. Silica has thus been deposited where it was originally most abundant, but while the original silica in a fairly soluble form was distributed throughout the chalk, it is now restricted to and concentrated in beds and nodules of flint in a form which is far less soluble.

Radiolarian cherts which may be the representatives of old oozes occur in the carboniferous rocks of Devon. A radiolarian siliceous deposit occurs in the Island of Barbados.

Rather soft incoherent deposits made up largely of diatom remains are called *Infusorial earth* or *Tripoli*. They are commercially valuable on account of their absorbent properties.

Coal:—Coal is mainly composed of hydrocarbons more or less oxygenated, and occurs in seams alternating with shales, fireclays and ganister, ironstones and sandstones, which have characters pointing to the nearness of land. The floor below the coal is generally an *underclay*, while the roof overlying the seam consists usually of sandstone.

There can be no doubt that coal is the relic of an ancient vegetation which was subsequently buried and mineralised. The pro-

gressive changes undergone are well illustrated by the following figures :—

Variety	*Carbon*	*Hydrogen*	*Oxygen and Nitrogen*	*Ash*
Wood ..	49·6	6·5	43·9	—
Humus ..	54·8	4·8	40·4	—
Peat	54	5	31	10
Lignite ..	67	6	24	3
Brown Coal ..	70	5	22	3
House Coal ..	76	6	16	2
Steam Coal ..	82	5	10	3
Anthracite ..	91	3	4	2
Graphite ..	99		—	1
Cannel ..	67	8	12	13

The figures are percentages.

The progressive change is clearly one of elimination of gases, leaving the residue enriched in carbon. *Peat* consists of stems roots, leaves, mosses and spores in various stages of decomposition, and is formed at the present day in water-logged bogs like those of Ireland. *Lignite* is a compressed peat buried beneath a covering of sediment, and still preserves vegetable structures. *Brown Coal* is intermediate between lignite and ordinary coal ; the woody structures are beginning to disappear. In *bituminous coal,* all the woody structures are obliterated. This variety cokes when burnt, and is used for household and gas-making purposes. *Steam coal* differs in giving off much less smoke, and so is transitional to *Anthracite* from which practically all the gaseous constituents have been removed.

Coal frequently illustrates its vegetable origin by containing actual leaves, bark, etc., of plants such as Neuropteris and Lepidodendron. Microscopic examination betrays the presence of spores of plants which are related to the ferns and horse tails of the present day. Anthracite is generally free from these traces of plant life and is found in regions which have been disturbed by considerable earth movements. When coal is deeply buried and subjected to powerful pressures and high temperatures it becomes metamorphosed into a pure crystalline carbon and is then one variety of *graphite.*

The *underclay* beneath seams of coal is frequently free from alkalis such as are required by plants. Moreover, fossil trees are occasionally found *in situ* (Sigillaria) with their roots (Stigmaria) spreading through the underclay. The latter therefore appears to be of the nature of an old soil.

Conditions of Coal Accumulation :— There are two theories to explain the mode of accumulation of coal, the " Growth *in situ* " theory, and the " Drift " theory. The first of these holds that coal is the result of the growth of luxuriant vegetation in low-lying swampy areas near the mouths and on the deltas of great rivers, and that coal seams now represent the original sites of these jungle swamps. In favour of this view are :—

(1) The nature of the underclay and the presence of fossil trees *in situ.*

(2) The great areas and purity of many seams. A seam in the Lancashire, Yorkshire and Derbyshire fields has been traced over 10,000 square miles. The ash of most British coals is not more than the original plants would contain.

(3) The absence of marine fossils and the occasional presence of land shells and reptile remains.

(4) The presence of " wash outs " or " horses " in coal seams. Here and there streams would run through the forests, and their silted up channels are now represented by masses of sediment which locally replaces the coal.

This theory successfully explains most of the British coal. After centuries of growth the land subsided, and a covering of sand, followed by clay, would bury up a thick layer of peaty matter. An upward movement would restore the jungle conditions and another seam of coal would be prepared. A long period of submergence alternating with episodes of rest or even elevation is indicated by the coal measures of the carboniferous.

The " Drift " theory assumes that coal seams represent the accumulation in estuaries, lagoons and lakes of drifted vegetable remains. *Cannel coal* is indisputably of this type. Its lack of purity, the presence of marine and estuarine shells and fish remains, the usual absence of vegetable structures, and the fact that it soon passes laterally into bituminous shales all point to a drifted origin. The certainty of " drift " in this case points to its improbability in other cases. Many continental coals belong to the " drift " type.

The conditions in which British coal is formed rule out the " Drift " theory as an explanation. In Vol. I., p. 362, is told the story of Nature as coal-provider. The various stages which mark the formation of the coal are indicated with the aid of a diagram. A. H.

METEOROLOGY.—III

In classifying clouds several things have to be considered: the appearance of clouds as seen from the earth, their altitudes and the various means by which the atmosphere at different levels is cooled. Since the appearance of a cloud largely depends upon its distance, a classification according to altitude gives very much the same results as classification based upon appearance. The mode of cooling of the air also has important bearings on the shapes and sizes of cloud masses, as has been pointed out in the lessons on Heat, Vol. II., pp. 70–72.

Classes of Clouds

Although we may classify clouds into groups we must remember that one so-called species of cloud may gradually merge into another species. It is sometimes difficult to describe the condition of the sky in terms of one or two simple cloud types, since the clouds present may be really combinations of several kinds. For the sake of description, however, we may recognise cloud types, or combination of types, as follows:—

Cirrus (recognised abbreviation *Ci*). white hair-like or feathery masses of ice particles situated at an average altitude of $5\frac{1}{2}$ miles. These are the highest types of clouds known.

Cirro-stratus (cir-s), thin white sheets, probably ice particles, spread over the sky at heights approaching that of the pure cirrus.

Cirro-cumulus (*Cir-cu*) small, white somewhat rounded forms, at times resembling a flock of sheep. These clouds have an average altitude of about 3 miles.

A variety of this type is popularly known as "mackerel sky." An alternative name for this class of cloud is **alto-cumulus** (*a-cu*).

Cumulus (*Cu*), great white rolling masses or rounded billowy forms appearing more often in summer than at other seasons. They are of great vertical thickness, their bases being usually about $\frac{3}{4}$ of a mile above the ground. while their upper portion may be as much as 3 miles. This type should be distinguished from

Cumulo-nimbus (*Cu-n*), which consist of large masses, white towards the top, where the outlines are more jagged than in true cumulus, and darkening towards the bases where they may be almost black. This is the type of cloud usually associated with thunderstorms.

Strato-cumulus (*S-cu*), grey clouds that sometimes render the sky entirely overcast by a uniform grey mantle, though rain usually does not fall. Their altitude is

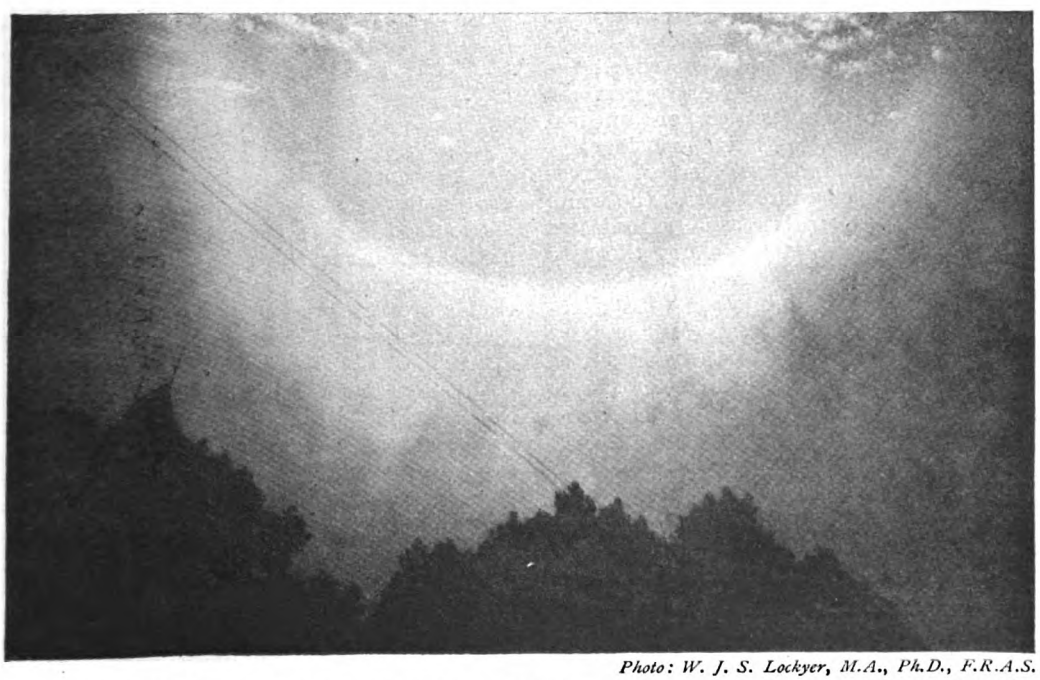


Photo: W. J. S. Lockyer, M.A., Ph.D., F.R.A.S.

A mixture of cirrus and cirro-stratus cloud producing the phenomenon known as parhelion, i.e. a faintly coloured halo round the sun which may be taken as a definite indication of stormy weather (*cf.* Vol. II., pp. 71 and 72).

about one mile. Sometimes this type is referred to as "dry stratus" as their presence does not necessarily mean wet weather.

Nimbus (*N*), or rain clouds, dark-grey or blackish masses having ragged outlines, associated with low-flying detached portions known as "flying scud." They are usually situated at a height of about one mile.

This class is considered to be another and darker combination of stratus with cumulus.

Stratus (*S*), dark, low-lying masses usually less than ½ mile in altitude. Since this class is usually produced by the cooling of the air just above the earth by radiation they are often seen at evening.

In this classification the types have been arranged in order of altitude. We must note here that no clouds occur at altitudes greater than about 6 miles. The very deep upper portion of the atmosphere is, during the period of daylight, a realm of perfect sunshine. The condition of the air upon which depends what we call "weather" appears to be determined by the state of things existing in strata of air situated between 5 and 6 miles above the earth.

Weather Significance of Clouds

In attempting to form some idea as to the nature of the weather likely to exist in the near future, the observer should note, not merely the kind of clouds present and their extent, but also the manner in which the clouds either develop or disappear. In some cases the appearance of unusual phenomena may also have considerable significance. Consider the case of cirrus clouds. Pure cirrus unmixed with the white sheets called cirro-stratus usually indicates fine weather; this is particularly the case if the cirrus gradually disappear. On the other hand, a mixture of cirrus with cirro-stratus, which may become thicker and gradually develop into nimbus, indicates the approach of bad weather. It sometimes happens that a mixture of cirrus and cirro-stratus may be associated with unusual phenomena known as *Parhelia*. These consist of faintly coloured halos or rings which appear to surround the sun or the moon. Mock suns or mock moons may be present in addition to the coloured halos, and the association of these parhelia with a mixture of cirrus and cirro-stratus is a definite sign of stormy weather, so much so, that they are known in nautical parlance as "wind-dogs."

The appearance of these phenomena is due to refraction and dispersion by the ice particles of the clouds of light coming from the sun or the moon as the case may be.

White sheets of cirro-stratus unmixed with cirrus may occur during a spell of fine weather, in which case these clouds may frequently disappear and reappear.

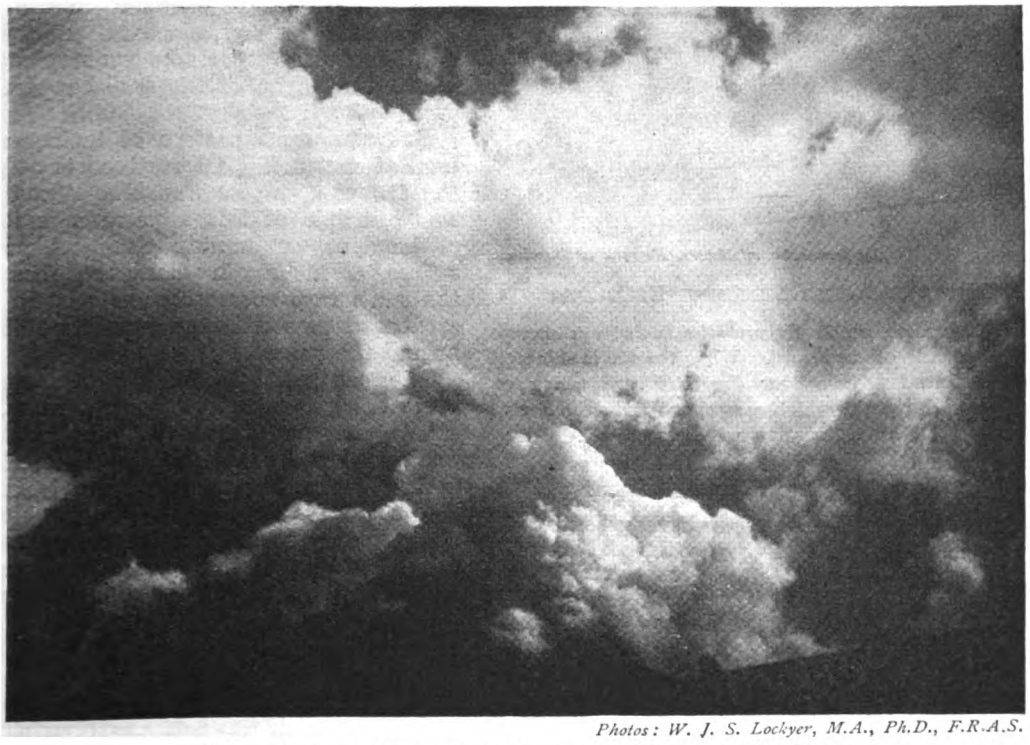
The masses of cirro-cumulus known as mackerel sky are almost invariably associated with showery weather, not properly fine and yet not thoroughly wet. Here again the student should note carefully how these clouds develop. If they eventually break up into small fragments, fine weather may be expected, but if they collect into much larger masses the reverse is usually the case. The great white rolling cumulus which may slowly disappear are clouds usually indicating fine weather, particularly if they do not darken in colour towards the base owing to development into cumulo-nimbus, a development which not only alters their colour, but modifies their rounded outlines, giving rise to picturesque castellated and jagged forms in the upper portions of the cloud. Should this development take place one may safely infer that a storm is approaching.

Every one in the British Islands is familiar with that uniform depressing grey sky which so often entirely covers the heavens. This layer of strato-cumulus, often associated with a north-east wind, may exist for several days at a time, and yet the weather remain quite dry.

State of the Sky

Its occurrence is more common during the winter months than at other times. Little need be said concerning the dark rain clouds or nimbus, since they invariably bring stormy weather, while the low-lying stratus clouds are really a kind of ground mist and do not necessarily indicate unfavourable conditions.

On monthly weather reports the state of the sky is described by statements of the degree of cloudiness rather than by any description of cloud forms present. A code of international symbols known as the *Beaufort Notation* is employed for this purpose, and these symbols are placed in a special column on the report form. Since many symbols of the Beaufort notation refer to other meteorological items, such as rainfall, the more commonly used symbols, referring to phenomena other than clouds, are also quoted here, and reference will be made to this table later.



Photos: W. J. S. Lockyer, M.A., Ph.D., F.R.A.S.

NIMBUS (*top*) AND CUMULO-NIMBUS (*bottom*) CLOUDS.

Nimbus, or rain clouds, are dark grey or blackish masses with ragged outlines. The low flying detached portions are known as "flying scud." Cumulo-Nimbus consist of large masses, white towards the top, darkening towards the base. This type of cloud is associated with thunder-storms (*cf.* Vol. II., pp. 71 and 72).

Some international symbols of the Beaufort Notation :

Symbol.	*Meaning.*
b	Blue sky. Clouds 0–3.
bc	Detached clouds 4–6.
c	Detached clouds 7 or 8.
o	Overcast sky 9 or 10.
u	Ugly threatening sky.
m ≡°	Mist.
f ≡	Fog.
v	Unusual visibility of distant objects.
g	Gloom.

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CAMPBELL-STOKES SUNSHINE RECORDER

is a glass sphere which focuses the sun's rays accurately on a strip of cardboard. When the sun is shining, the concentrated rays char the cardboard which is graduated with marks which correspond with the hours between sunrise and sunset.

Symbol.	*Meaning.*	*Symbol.*	*Meaning.*
l	No precipitation (no rain in gauge).	p ●	Passing showers.
r ●	Rain.	d ●	Drizzling rain.
t T	Thunder.	✳	Snow.
l <	Lightning.	⊠	Snow lying.
⊼	Thunderstorm.	⊹	Snow drift.
e	Wet air without rain.	r s	Sleet.
y	Dry Air.	q	Squalls.
h ▲	Hail.	⌒	Rainbow.
△	Soft hail.	⊕	Solar halo.
w ⌓	Dew.	ω	Lunar halo.
x ⌴	Hoar frost.	⌂	Aurora.
⌒	Gale.	◗	Zodiacal light.
		z	Dust haze.

If the sky shows no clouds at all, b 0 is entered on the report form ; if one cloud is present, b 1 is entered ; slightly more clouds and either b 2 or b 3 must be recorded. Sky that is absolutely overcast is expressed by o 10, but if a patch of blue shows through at one place, the symbol for that state is o 9.

States of cloudiness between b 3 and o 9 are expressed by symbols ranging from bc 4 to c 8, according to the proportion of detached cloud. The registration of cloudiness is a meteorological item which must be left to the discretion of the observer, in other words, the personal element steps in.

Sunshine Recorders

The state of the sky, as far as the obstruction of bright sunshine is concerned, is recorded by instruments termed sunshine recorders. In some of these instruments sensitive photographic paper placed in a box having a small aperture is affected by bright sunshine, but not to the same extent by diffused light when the sun is obscured by clouds. In this way, the paper records the periods of sunshine and dullness during the day, since an unaltered portion of the paper represents cloudiness in the region of the sun's apparent path through the sky.

But the usual pattern of instrument used at meteorological stations is called the *Campbell - Stokes Sunshine Recorder*. The principle of this apparatus is that of the lens, or burning glass. A glass sphere, 4 inches in diameter, focuses the sun's rays accurately on a strip of cardboard placed in the correct position behind the sphere.

The cardboard is held in the right position by a frame which is a part of a sphere concentric with the glass globe. No matter what the position of the sun may be in the heavens, the sphere, if properly fixed and adjusted for latitude, brings the sun's rays to a focus on some portion of the cardboard. The heat of the concentrated rays chars the cardboard when the sun is shining. The strips of cardboard are graduated with marks which correspond to the hours between sunrise and sunset. The hour divisions are subdivided into tenths. At the end of a day on which the sun has been shining intermittently, the cardboard exhibits scorched patches in places, and unaltered paper between the scorches.

It is not always easy to select a site suitable for a sunshine recorder, since no objects — houses, trees, etc. — must be allowed to come between the sun and the

instrument at any time between sunrise and sunset.

When setting up a Campbell-Stokes' recorder several important conditions must be strictly observed. The base of the instrument must be quite level, the sphere must face south, the axis of the sphere must be in a true north and south line so that the recording paper extends in an arc properly east and west; and further, the axis of the sphere must make an angle with the horizon equal to the latitude of the place. This last item is extremely important since the elevation of the sun in the heavens depends mainly on latitude, but to some extent upon the season. Thus, in British latitudes the sun's elevation is greater in summer than in winter; or put in another way, the sun's daylight pathway describes on a summer day a greater arc than it describes during a day in winter. Hence the cardboard forms used with a sunshine recorder are of different lengths—longer ones for summer, shorter ones for the winter season, and a third type is used during spring and autumn.

Not only do the length and shape of the cards vary, but their positions on the frame of the recorder also vary according to season, and should the student propose to do serious work with a Campbell-Stokes' recorder, he should communicate with the Meteorological Office.

It must be emphasised that sunshine recorders do not record the state of the sky as a whole, but only that of the portion of the sky wherein is situated the apparent pathway of the sun. If a cloud obscures the sun, no sunshine is recorded, though the remaining part of the heavens may be quite clear. Cloudiness, or otherwise, at night may be recorded by photographic means. If a camera is mounted to take a continuous photographic impression of a star, the photographic plate will yield a continuous streak (due to the movement of the earth relative to the star) as long as no clouds come between the camera and the star. A break in the line traced on the plate indicates the corresponding intervention of clouds.

The actual temperature of the sun's rays, which is quite a different thing from the temperature of the air, is measured by a *Solar Radiation Thermometer* which consists of a thermometer with a blackened bulb placed in a vacuum by means of an outer case. The inner black bulb thermometer is thus effectively screened from air currents, etc., and the readings indicate temperatures "in the sun." The thermometer must be mounted on a pole 4 feet above the ground and the bulb must face the south.

By permission of Messrs. Negretti & Zambra.

SOLAR RADIATION THERMOMETER.

The position 4 feet above the ground is necessary to ensure that ground influences, such as radiation, do not affect the instrument.

In another type of instrument called an *Actinometer*, used to measure the amount of sunshine, a similar black bulb thermometer is employed. Its record is compared with that of another ordinary thermometer, and a comparison of the results gives an indication of the periods of bright sunshine, since the black bulb instrument gives, during such sunny periods, a much higher temperature than the ordinary thermometer does.

L. M. P.

ANATOMY AND PHYSIOLOGY. XV

OUR review of the working of the human machine is now complete. We have found out the following facts: work is done by muscles, moving bony levers. The muscles do their work by burning up part of their own carbon, as coal is burnt in a furnace. The fuel is supplied by food, which is digested in the intestines, and carried to the muscles in the blood by the circulatory system. The oxygen required is also carried in the blood, and replenished in the lungs. The waste products are got rid of by the kidneys, lungs, and skin.

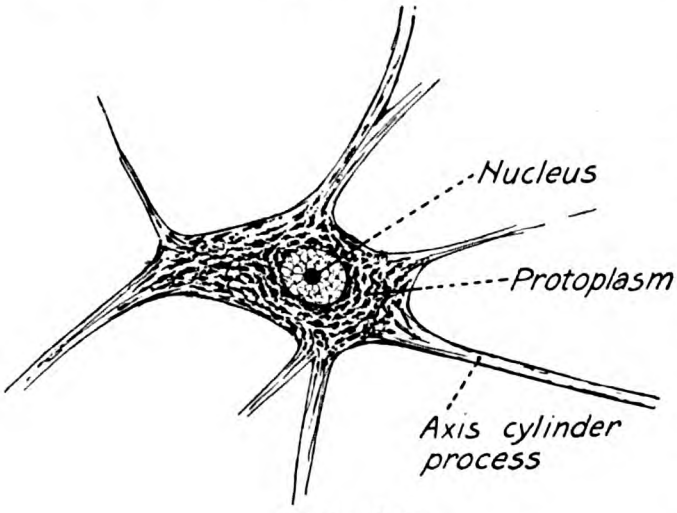
The Nervous System

We have now to consider how the muscles are controlled and made to do just those things which we want them to do. This is the function of the central nervous system, which consists of the brain, the spinal cord, and the nerves.

The nerves are of two kinds, sensory and motor, sometimes called *afferent*, which means "carrying to," and *efferent*, which means "carrying from." For simple movements

it is enough to have a sensory nerve whose cell-processes are in communication with a motor nerve. Both of these may be in the spinal cord, and there may be no conscious sensation or conscious movement. The spinal cord is made of junction stations of this kind, and of tracts of nerve fibres going to and coming from the brain (*cf.* Vol. IV., p. 85).

But not all movements are simple ones of this character. All conscious movements are much more complicated. The seat of consciousness is the brain, and for any conscious movement to be performed impulses



NERVE CELL.

have to reach the brain by sensory nerve fibres, and other impulses have to leave it by motor fibres. Consider such a performance as playing the piano.

Playing consists in making delicate and very accurate movements with the fingers. The accuracy depends on sensations coming from your fingers to your brain; there is a part of the brain which appreciates these sensations.

The Evidences of Sensations

While you are playing you are reading the music, sensations are passing from your eyes to your brain, and there are communications between the part which appreciates sight and the part which controls the movements of your fingers. And the whole act of playing is done for the sake of producing sounds, which are appreciated in another part of your brain. So that in piano playing at least four parts of your brain are occupied at once: the part that appreciates the feeling of your fingers, the part that appreciates sight, the part that appreciates hearing, and the part that controls the movements of your fingers. Add to that the fact that your eyes have to move in an exact way, as well as your fingers, and it will be understood why the brain, which has to find space for all these functions, is a large organ. If you sing as well as play, there are the movements of the larynx and mouth to be added to all these.

Not only does the brain appreciate and understand impressions of feeling, hearing, sight, and so forth, but it *stores* those impressions; it has a memory, and it is on memory that a great deal of consciousness depends.

The Function of Memory

You can shut your eyes and recall your mother's face, you can hear her voice. This means that your brain in the past has received impressions of her face and voice, and has stored these impressions, so that you can recall them at will. You cannot be conscious of anything without a memory; you must be able to compare a sensation now going on with the memory of past sensations if you are to be truly conscious of it.

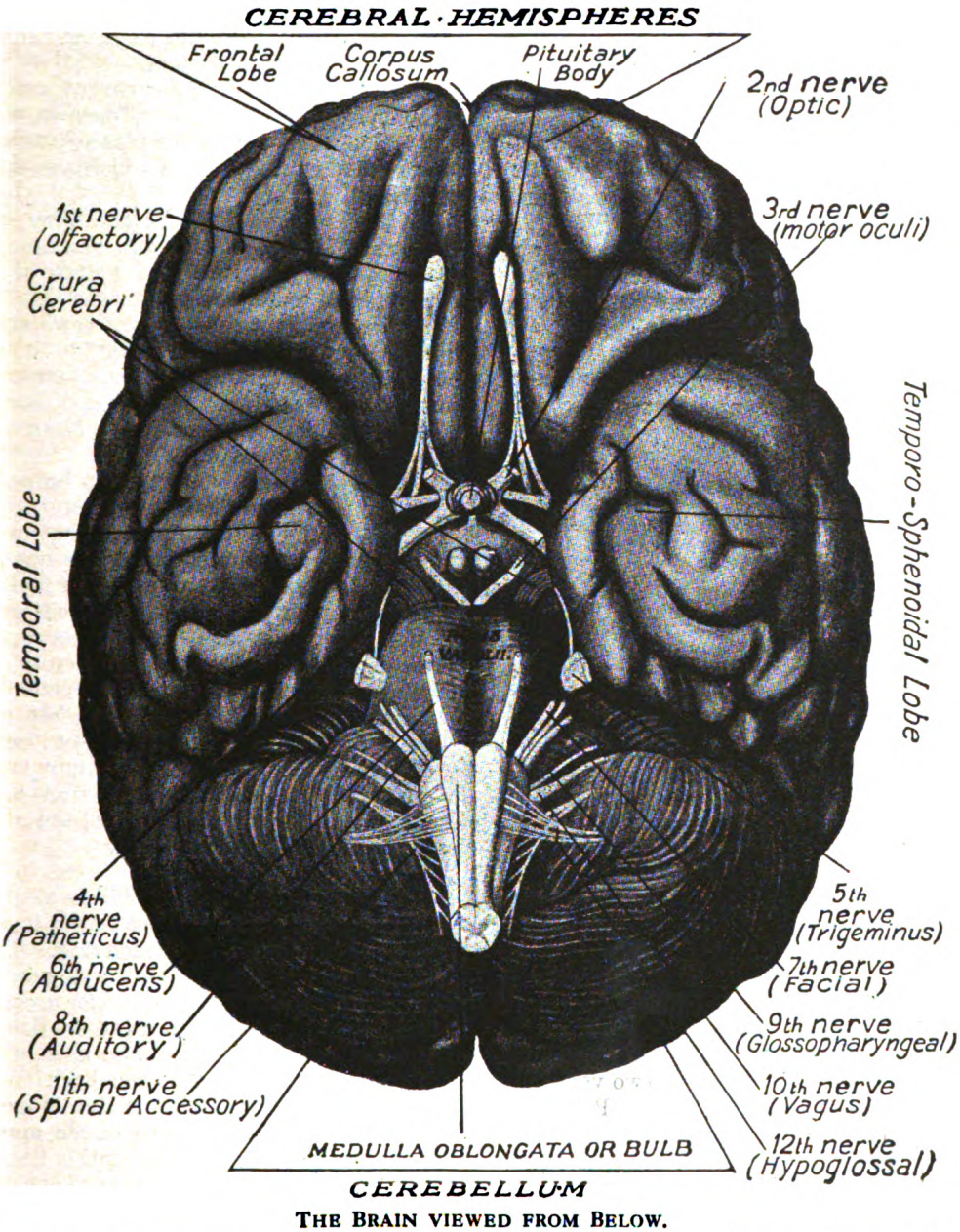
The brain differs from the spinal cord, therefore, in the great variety of sensations which it appreciates, and, guided by which, it sends out motor impulses. It also can store and recall past impressions.

Another point is that the conscious movements started by the brain are *controlled* movements. When you wish to strike a chord on the piano your fingers have to spread out, but only just so far—the spreading movement has to be checked.

The whole nervous system then is one great mass of nerve fibres, which bring impulses from all possible surfaces to particular centres which can appreciate them, of nerve fibres which start motor impulses, and of nerve fibres which establish communication between the different sensory and motor areas.

No movement is ever made except in response to some sensory impulse, or the memory of a previous impulse.

A nerve cell consists of a central mass of protoplasm containing a nucleus, from which spread out "processes," fibres, or threads of cell substance arranged something like



THE BRAIN VIEWED FROM BELOW.

Showing the principal parts of the organ which, by means of nerves, controls the human mechanism. No telephone exchange approaches its complexity.

the roots of a plant. One of these fibres is very long, and is called the *axis cylinder process*, and this carries the impulses from the nerve fibre.

The short processes are in communication with similar processes from other nerve cells, and receive the impulses which the axis cylinder process has to pass on.

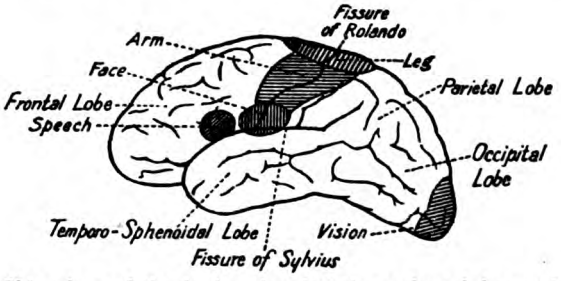
Such fibres are said to be *medullated*. In the nervous system parts made up of medullated fibres are called "white matter," and parts made up of cell bodies which are not medullated are called "grey matter."

The nervous system is divided into the brain and spinal cord, and nerves. The brain is the part inside the skull, and the rest is outside, but the part immediately above the spinal cord is very similar to it in structure, while the upper part differs.

The upper part of the brain consists of

the *cerebral hemispheres*, and these make up the great bulk of the brain. In them is the seat of consciousness and the areas which appreciate sight and hearing and common sensation, and from them start the nerve fibres which actuate voluntary movement.

The fibres going to and coming from the hemispheres are gathered into two great trunks, called the *crura*, or "legs" of the brain. They join into one and form a tube which has grey matter (nerve cells) immediately lining it, and white matter (nerve fibres) outside the grey matter. This tube, the brain stem, passes back to the foramen magnum, where it becomes the spinal cord, which also has white matter outside, grey



Side view of the brain, showing the various lobes and centres of control.

matter within, and a tube, the central canal, inside the grey matter.

Inside the brain this tube ends in front in a little cavity, called the third ventricle. On the side wall of this cavity on each side is a hole, and through this hole you pass into the cavity of the cerebral hemisphere. Behind the third ventricle the passage is very narrow, and is called the aqueduct of Sylvius, and behind the aqueduct of Sylvius it widens out again into another cavity called the fourth ventricle. The first two ventricles are in the cerebral hemispheres. Below the fourth ventricle the passage becomes very narrow again, and continues so after it has entered the spinal cord.

This complicated arrangement comes about in this way. While the body is being developed, before birth, the nervous system first appears as a groove on the back. The walls of this groove grow up and close in, and so form a tube, which persists as the central canal.

The upper end of this canal now swells out and gets bigger, but this swollen end is nipped at two places, so that the upper-end of the canal consists of three swellings, one behind the other, and these form what are called the fore-, mid-, and hind-brain. A pocket grows out of the fore-brain, and this divides into two and forms the cerebral hemispheres, so these differ from the original plan of the nervous system.

There are a pair of these nerves to each segment of the spinal cord, one on each side. Their nerve cells are placed just outside the cord in little knots which are called *ganglia*.

The fibres leave the cell, and very soon divide into two branches: one branch runs outwards and joins the motor fibre of the segment, and is distributed to the skin, the other branch enters the spinal cord at its side and runs up the back part of it, and finally ends in a collection of cells just inside the skull called the *gracile* and *cuneate nuclei*. This lower end of the brain-stem is called the *medulla*.

Here a remarkable fact must be noted. Fresh fibres start from these nuclei, which finally reach the cerebral cortex, but they go to the cortex *of the opposite side*. That is, the nerves which feel the sensations in your right hand, enter the spinal cord on the right, pass up to the medulla on the right, then cross over to the opposite side in a track called the fillet, and passing through the left mid-brain go to the left cerebral cortex. Before a sensation can reach your brain it has to go through at least two different nerve fibres, one as far as the medulla, the other from the medulla to the brain.

The Motor Nerves

There are also a pair of these nerves to each segment of the cord, one on each side. Their fibres all start in the cerebral cortex in one particular part, known as the *motor area*. It is to be found by taking a point on the top of the skull half-way from the root of the nose to the bony lump at the back of the skull just above the neck. A line is drawn from this point to the angle of the mouth. The top three or four inches of this line are just in front of the motor area.

The motor fibres start from this area, those which move to the face are at its lower part, the fibres for the hand and arm above this, for the leg higher up still, and for the trunk at the top.

The fibres, therefore, are a good deal spread out. To reach the limbs they run down towards the spinal cord and are collected together into a narrow bundle called the *pyramidal tract*, which runs down round the side of the third ventricle into the mid-brain, and the crus of its side, and so enters the medulla. At the lower end of the medulla these fibres also cross to

the other side and enter the spinal cord. In the cord they run down the side and end by turning into the central grey matter in a part called the *anterior horn*. Here their ends are in contact with the cells of the anterior horn, and from these cells long processes pass out which leave the cord and join up with the sensory nerve of the segment, along with which they travel out to the limbs and body generally, and are distributed to the muscles.

An impulse coming from the right side of the brain therefore has to pass to the left side of the body, and has also to pass through two separate fibres which are called respectively the *upper* and *lower motor neuron*.

The motor nerves supplying the face start in the grey matter of the mid- and hind-brain, many of them in the floor of the fourth ventricle.

The chief sensory nerve of the face starts in the same way as the sensory nerves of the body in a large ganglion outside the base of the brain.

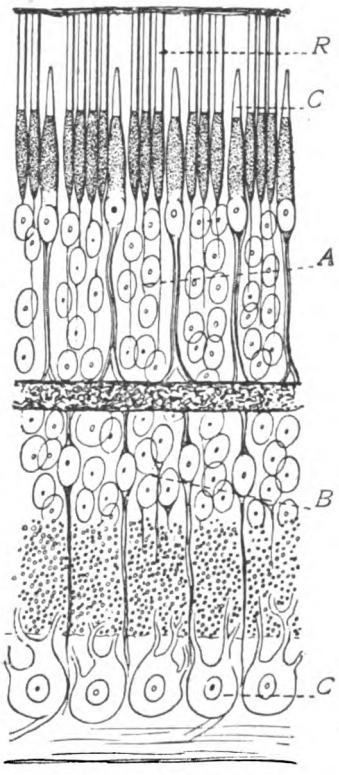
Anatomy of the Brain

One other part of the brain is still to be mentioned. We have spoken of the cerebral hemispheres as originally being outgrowths from the fore-brain. There is also an outgrowth from the hind-brain, called the *cerebellum*. This is a mass of brain substance which is placed over the fourth ventricle, and on the under side of the brain stem at this point is the *pons Varolii*, a stout band of fibres passing from one side to the other, and appearing to secure the cerebellum to the brain stem.

We now know enough about the brain and cord to discuss their general anatomy. Looked at from above the brain consists of an oval mass divided by a deep furrow—the great longitudinal fissure—into two symmetrical halves, the cerebral hemispheres. The surface is much "crinkled," being divided into ridges by furrows; these ridges or "convolutions" are very much alike in all brains, and the motor area, and the areas for sight and hearing, and many others are known to be placed in particular convolutions. If the two halves of the brain are separated you can see at the bottom of the great longitudinal fissure a mass of tissue—the *corpus callosum*, which joins the two hemispheres.

Now look at the brain from the side. It has the appearance of a long pillow folded into two unequal halves, the top half projecting farther forward than the bottom. The fissure of Sylvius separates the two parts.

The side view of the brain is divided into separate areas called *lobes*. The front end of the upper fold is called the frontal lobe; it contains the area for consciousness and reason, and also the area for appreciating smell. Behind it is a fissure, the fissure of Rolando, which runs from the beginning of



THE RETINA OF THE EYE

magnified, showing the relations of the cell layers to the rods and cones in the transmission of the sensation of light to the brain.

R = Rods; C = Cones; A = Outer nuclear layer; B = Inner nuclear layer; C = Layer of optic nerve cells.

the fissure of Sylvius towards the top of the upper border. Behind this is the parietal lobe; it contains the motor area.

The fold of the pillow is the occipital lobe; here are the centres for sight. The lower fold below the fissure of Sylvius is the temporo-sphenoidal lobe; here are the centres for hearing.

Apparently coming out from between the frontal and temporo-sphenoidal lobes is the crus cerebri of each side, these unite together under the *pons Varolii*, which runs into the cerebellum on each side. Below the pons is the medulla oblongata, continuous with the spinal cord. D. W. C. - J.

Continued from page 48.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A.[Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

LATIN.—XXXV

ORATIO obliqua or indirect discourse is the form of construction employed when the words of another person are quoted, not as he delivered them, but after a verb of saying, asking, or requesting, whether this is expressed or merely understood. This is a grammatical form found in all languages.

Oratio Obliqua

Thus we read in a parliamentary report: "The honourable member said that he was opposed to the motion. He did not believe that the Government deserved the confidence which had been reposed in them." The words actually used by the speaker were: "I do not believe the Government deserve the confidence which has been reposed in them." Notice that here, as in Latin, the third person is used instead of the first, and secondary tenses take the place of primary.

This form of indirect discourse is found, not only in long reported speeches, but in all clauses giving reasons, definitions, questions, conditions, etc., quoted as the words or views of another. The rules we are about to consider hold good for all such clauses.

In oratio obliqua the third person is used throughout. The reflexive **sē** regularly takes the place of the first personal pronoun; the demonstratives **is, illĕ,** etc., are used for the second and third persons.

Neither the indicative nor the imperative mood is ever used in oratio obliqua.

There are three kinds of principal clauses—statements, questions, and commands or requests. Let us see how these are translated from oratio recta or direct discourse into oratio obliqua.

Statements, whether they appear in oratio recta in the indicative or the subjunctive, are expressed in oratio obliqua by the infinitive with the accusative, a construction with which you are already well acquainted. Thus the sentence—

Nec nos fefellit hoc donum inimicorum veneno inlitum esse.
Nor did it escape us that this gift of our enemies was envenomed

becomes in oratio obliqua, as given by Livy—

Nec se fefellisse id donum inimicorum veneno inlitum esse.

The verb **nĕgō**, *deny*, is preferred in negative statements to a verb of saying with **nōn**, thus—

Negavit illum venturum esse.
He said that the man would not come.

Questions are made indirect, when they depend on a verb of asking or when they are deliberative questions, in the ways already described for dependent questions (*see* p. 212, Vol. V.), the subjunctive in oratio recta being retained in oratio obliqua.

Questions addressed to the first or third person (usually rhetorical questions to which no answer is expected) are expressed by the infinitive in oratio obliqua.

Questions addressed to the second person are put in a secondary tense of the subjunctive.

Thus *What do I wish?* becomes **quid se velle?** *What do they wish?* **quid illos velle?** *What do you wish?* **quid illi vellent?**

Tenses in Oratio Obliqua

Commands or requests, whether in the imperative or subjunctive in oratio recta, are put in the subjunctive after **ŭt,** in oratio obliqua, except when they follow the verb **iŭbĕō**, *command*, or **vĕtō**, *forbid*, when in accordance with the rule already given they are put in the infinitive with the accusative. Principal statements, when they are made indirect, are put in the present, past, or future infinitive according as the original

verb in oratio recta expressed present, past, or future time.

The rules regarding the sequence of tenses in dependent clauses (*see* Vol. V., p. 460) apply to the tenses of the subjunctive in oratio obliqua.

If the oratio obliqua is introduced by a verb in a secondary tense, that is, if the speech or statement is represented as made in the past, the secondary tenses are not altered. But if it is introduced by a primary tense, primary tenses are used throughout, and are sometimes found even after a principal verb in a secondary tense for the sake of reproducing the exact words.

The apodosis of a conditional sentence in oratio recta containing an imperfect or pluperfect subjunctive, is expressed in oratio obliqua by **fŏrĕ ŭt**, the future participle with **fŭissĕ ŭt**, or if passive by **fŭtūrum fŭissĕ ŭt**, with the subjunctive.

The best way to enable you to grasp the chief characteristics of oratio obliqua and its relations to oratio recta, is to give some examples of the same statements expressed in both ways, direct and reported.

Oratio recta	*Oratio obliqua*
Res omnis mihi tecum est. Dicam aperte. Si te mecum dicendo ac diluendis criminibus in hac causa contendere putarem, ego quoque in accusando operam consumerem.	(Dixit) rem omnem sibi cum illo esse. Dicturum aperte. Si illum secum dicendo ac diluendis criminibus in ea causa contendere putasset, se quoque in accusando operam consumpturum fuisse.
The matter is entirely between you and me. I will speak plainly. If you could contend with me in this cause by arguing and refuting charges, I also would devote my efforts to impeachment.	(He said) *that the matter lay entirely between himself and him. He would speak plainly. If he had thought that he could contend with himself in this cause by means of argument and refuting charges, he himself would also devote his efforts to impeachment.*
Senatum obtestor, ne Romanum cum Saguntino suscitent bellum; monui, praedixi (ego), ne Hamilcaris progeniem ad exercitus mitterent (or mitteretis). Non manes, non stirps eius conquiescunt viri, nec unquam, donec sanguinis nominisque Barcini quisquam superest, quiescent Romana foedera.	Senatum obtestari, ne Romanum cum Saguntino suscitarent bellum; monuisse, praedixisse se, ne Hamilcaris progeniem ad exercitum mitterent; non manes, non stirpem eius conquiescere viri, nec usquam, donec sanguinis nominisque Barcini quisquam supersit, quietura Romana foedera.
I implore the Senate, not to excite a Roman along with the Saguntine war; I have cautioned, I have forewarned that they should not send the offspring of Hamilcar to the army. The manes, the lineage of that man slumber not, nor ever, so long as any survives of the blood and name of Barca, will the Roman alliances rest.	*That he implored the Senate not to excite a Roman along with the Saguntine war; that he had cautioned, that he had forewarned, not to send the offspring of Hamilcar to the army; that the manes, the lineage of that man were not slumbering, nor ever, so long as any of the blood and name of Barca survived, would the Roman alliances rest.*
Tempus iam adest, ut hostem vincatis, vobisque ipsis gloriam, quam victi nuper amisisti, iterum recuperetis. Suo quisque duci libenter pareat, et signa impavidus sequatur.	Tempus iam adesse, ut hostem vincerent, sibique ipsis gloriam, quam victi nuper amisissent, iterum recuperarent. Suo quisque duci libenter pareret, et signa impavidus sequatur.
The moment has come for you to vanquish the foe, and once more recover the glory that you lately lost in defeat. Let each obey his leader with good will, and follow the standard undauntedly.	*That the moment had come for vanquishing the foe, and recovering once more the glory that they had lately lost in defeat. Let each obey his leader with good will, and follow the standard undauntedly.*
Habetis, milites, quam petiistis facultatem. Hostem impedito atque inique loco tenetis. Imperatorem adesse existimate.	(Dixit) habere milites quam petiissent facultatem: hostem impedito atque iniquo loco tenere—imperatorem adesse existimarent.
Soldiers, you have the opportunity that you have sought. You hold the enemy in a congested and unfavourable spot. Bear in mind that your general is at hand.	*He told the soldiers that they had the opportunity that they had sought: that they held the enemy in a congested and unfavourable spot: let them bear in mind that their general was at hand.*

Exercise 34

Turn the following into oratio obliqua and translate into English:—

Juvenem flagrantem cupidine regni ad exercitus misistis. Aluistis ergo hoc incendium quo nunc ardetis. Saguntum vestri circumsedent exercitus, unde arcentur foedere; mox Carthaginem circumsedebunt Romanae legiones, ducibus eisdem dis, per quos priore bello se sunt ulti. Utrum hostem an vos an fortunam utriusque populi ignoratis? Legatos imperator vester in castra non admisit; jus gentium sustulit; hi tamen ad nos venerunt; ut publica fraus absit, auctorem culpae deposcunt. Quo lenius agunt, eo, cum coeperint, vereor, ne

perseverantius saeviant. Aegates insulas ante oculos proponite, quae terra marique passi sitis. Nec puer hic dux erat, sed pater ipse Hamilcar, Mars alter, ut isti volunt . . . Sagunti ruinae (falsus utinam vates sim) nostris capitibus incident, susceptumque cum Saguntinis bellum habendum cum Romanis est. Dedemus ergo Hannibalem ? rogabit aliquis. Scio meam levem esse in eo auctoritatem ; sed et Hamilcarem eo periisse laetatus sum, quod, si ille viveret, bellum jam haberemus cum Romanis, et hunc juvenem tanquam furiam facemque hujus belli odi ac detestor; nec dedendum solum ad piaculum rupti foederis, sed, si nemo deposcat, ablegandum eo, unde nec ad nos nomen famaque ejus accidere neque ille sollicitare quietae civitatis statum possit.

Translate into Latin, in oratio obliqua :—

To none of them did the victory seem greater and more complete than to the general himself. He was transported with delight at the thought that he had won a victory with the very branch of the army with which his colleague had been defeated. It had brought back the courage of the soldiers, and revived their spirits, and there was no one except his colleague in command who wished the struggle to be deferred. He was more disabled in mind than in body, and it was the recollection of his wound that made him shrink from a battle and its bullets. But they must not lose their energy along with him. To what purpose was further delay, or loss of opportunity ? Were they waiting for a third general, and another army ? The French camp was pitched in Italy, almost in sight of the Eternal City itself. It was not now Sicily and Sardinia that were being attacked, but they were being driven from the land of their fathers, the country of their birth. " What lamentation there would be," he cried, " among our ancestors, who used to wage war round the very walls of the enemy's capital, if they could see us, their descendants—two generals and two full armies—cowering in terror inside our camp in the middle of Italy, and the French masters of the whole country between the Alps and the Apennines ! " Accordingly, disregarding the opposition of his disabled colleague, he ordered the soldiers to prepare for an immediate battle.

Key to Exercise 33

1. In a philosopher, if he had eloquence to offer, I should not disparage it ; if he had it not, I should not clamour for it. 2. If you prove to me what you say, I shall willingly agree. 3. If that alone were pleasure which flowed into the senses, so to speak, with an accompaniment of sweetness, no part of our body would be contented with mere freedom from pain without a pleasant sensation as well. 4. If, on the other hand, as Epicurus maintains, the highest pleasure is to be free from pain, the first of your concessions was right, that when the hand was thus affected, it felt no want. 5. If a life full of pain is above all things to be shunned, surely it is the greatest evil to live in pain. 6. But Epicurus says, " Who would think virtue worth having, unless it involved pleasure ? "

1. Si me ad cenam invitabis, tecum cras veniam laetus. 2. Faciam si potero. 3. Ubi urbem cepero redibo. 4. Si amici mei desiderio me moveri negem, certe mentiar. 5. Si in templum faces ferre vellet, sibi faciendum putaret. 6. Difficile est amicitiam manere, si a virtute defeceris. E. A. B.

RUSSIAN.—XXV

After л :

Лѣвый,	*left side.*
Лѣзть,	*to creep, climb.*
Лѣстница,	*staircase, ladder.*
Лѣчи́ть,	*to cure.*
Лѣнь,	*laziness.*
Лѣнтя́й,	*the lazy.*
Лѣпи́ть,	*to stick, model.*
Нелѣпость,	*nonsense.*
Великолѣпный,	*magnificent.*
Лѣсъ,	*forest, timber.*
Лѣто,	*summer.*
Лѣта́,	*years, age.*
Малолѣтній,	*minor, under-aged.*
Многолѣтній,	*of many years.*
Блѣдный,	*pale.*
Желѣзо,	*iron.*
Колѣно,	*knee, link, joint, tribe.*
Поколѣніе,	*generation.*
Плѣнъ,	*captivity.*

After м :

Мѣдь,	*copper.*
Мѣлъ,	*chalk.*
Перемѣна,	*a change.*
Обмѣнъ, размѣнъ,	*exchange.*
Измѣна,	*treason.*
Отмѣна,	*abrogation, revocation, cancellation.*
Измѣне́ніе,	*alteration, modification.*
Вы́мѣнъ,	*barter, exchange.*
Непремѣнно,	*infallibly.*
Мѣра,	*a measure.*
Измѣрить, измѣря́ть,	*to measure.*
Намѣре́ніе,	*intention.*
Намѣреваться,	*to intend.*
Лицемѣръ,	*a hypocrite.*
Мѣсяцъ,	*a month.*

After н :

Нѣжный,	*delicate.*
Нѣмо́й,	*dumb, mute.*
Нѣмецъ,	*a German.*
Гнѣвъ,	*anger.*
Гнѣздо́,	*a nest.*
Снѣгъ,	*snow.*
Нѣтъ,	*there is not, no !*

After п :

Пѣна,	*foam, scum.*
Пѣхо́та,	*infantry.*
Пѣшко́мъ,	*on foot.*
Спѣши́ть,	*to hasten.*
Успѣхъ,	*success.*
Успѣть, успѣва́ть,	*to succeed.*
Пѣть,	*to sing.*
Пѣсня,	*a song.*
Пѣту́хъ,	*a cock.*

After р :

Рѣдко,	*rarely, seldom.*
Рѣдька,	*a radish.*
Рѣзать,	*to cut, carve.*
Рѣзьба́,	*the carving.*
Рѣка́,	*a river.*

Рѣпа, *a turnip.*
Рѣсница, *an eyelash.*
Встрѣтить, встрѣчáть, *to meet.*
Пріобрѣсть, пріобрѣтáть, *to acquire.*
Рѣчь, *the speech.*
Орѣхъ, *a nut.*
Рѣшáть, рѣшúть, *to solve, decide.*
Рѣшéніе, *the decision, solution.*
Рѣшúтельный, *decided, determined, resolute, decisive.*
Рѣшето, *a sieve.*
Рѣшётка, *a grate.*
Грѣхъ, *a sin.*
Погрѣшность, *error, mistake, fault.*

After с:

Сѣверъ, *the North.*
Засѣдáть, *to sit.*
Засѣдáтель, *a juryman.*
Предсѣдáть, предсѣдáтельствовать, *to preside.*
Предсѣдáтель, *the chairman.*
Сосѣдъ, *a neighbour.*
Сосѣдство, *neighbourhood.*
Сосѣдній, *neighbouring, vicinal.*
Сѣдлó, *a saddle.*
Бесѣда, *conversation.*
Бесѣдка, *a summer-cottage, summer-house, kiosk, stool.*
Сѣдóй, *grey-headed.*
Сѣчь, *to hack, chop, hew.*
Сѣченіе, *the section.*
Насѣкóмое, *an insect.*
Сѣно, *hay.*
Сѣра, *brimstone, sulphur.*
Сѣрый, *grey.*
Сѣть, *a net, network, system.*
Посѣтúть, посѣщáть, *to visit.*
Посѣщéніе, *a visit.*
Сѣять, *to sow.*
Сѣялка, *a sowing machine.*
Сѣмя, *seed.*

After т:

Тѣло, *a body.*
Тѣнь, *a shadow.*
Стѣнá, *a wall.*
Застѣнчивый, *shy, timid.*
Тѣсный, *pressed, crushed.*
Стѣснúться, *to lack in courage.*
Стѣснúть, *to inconvenience.*
Притѣснúть, *to oppress.*
Стѣснéніе, *the pressing together, timidity.*
Притѣснéніе, *oppression.*
Тѣсто, *the dough.*
Затѣя, *a new idea, device, parture.*
Затѣять, *to conceive a new idea, plan, device.*

After ц:

Цѣдúть, *to decant, strain, filter.*
Цѣлый, *whole, complete, entire.*
Цѣловáть, *to kiss.*
Цѣлкóвый, *a silver rouble piece.*
Цѣль, *the aim, purpose.*
Безцѣльно, *aimlessly.*
Цѣлесообрáзно, *useful, serving a purpose.*
Цѣнá, *the price, value.*
Цѣнный; драгоцѣнный, *valuable, of value, precious.*
Цѣнúть, оцѣнúть, *to price, value, appreciate.*
Цѣнúться, *to be at the price of, to have the value of.*
Цѣпь, *a chain.*
Цѣпи, *fetters.*
Цѣпóчка, *a watch chain.*

246. ѣ is written at the beginning of the following two verbs, ѣхать, *to ride, travel, go to,* and ѣсть, *to eat.*

247. The "ѣ" is retained in all the words derived from the above two verbs, as follows:

Ѣздá, *the riding, travelling.*
Поѣздка, *a journey, trip.*
Объѣздъ, *the riding round.*
Разъѣздъ, *the travelling about.*
Пріѣздъ, *the arrival.*
Отъѣздъ, *the departure.*
Проѣздъ, *the passing through.*
Переѣздъ, *the crossing over.*
Обѣдать, *to have dinner.*
Обѣдъ, *the dinner.*
Обѣдня, *the mass, liturgy.*
Съѣдáть, объѣсть, *to eat or gnaw round, to eat up.*
Медвѣдь, *a bear.*
Медвѣжій, *a bear's* (adj.).
Надоѣдáть, *to importune, bother.*
Вы́ѣдать, вы́ѣсть, *to gnaw, corrode.*
Разъѣдáть, разъѣсть, *to corrode.*

248. The vowel "ѣ" is to be written:—

(*a*) At the end of the Prepositional case Singular, of all Masculine Nouns.

(*b*) At the end of Dative and Prepositional cases, Singular, of Feminine Nouns ending with **-а** or **-я** in the Nominative.

(*c*) At the end of the Prepositional case, Singular, of Neuter Nouns ending with -о or -е in the Nominative.

(*d*) In Comparative and Superlative Adjectives, for example, добрѣе, добрѣйшій, *more kind-hearted, most kind-hearted.*

(*e*) In all the cases of Plural of Feminine Numbers, such as одни́ѣ, óбѣ, двѣнáдцать, *several, both, twelve.*

(*f*) In the Dative and Prepositional cases of Personal Pronouns, such as мнѣ, тебѣ, себѣ, óбо мнѣ, о тебѣ, о себѣ, *to me, to you, to oneself; about me, about thee, about oneself.*

(*g*) In the following Pronouns of Instrumental, Singular, кѣмъ, чѣмъ, тѣмъ, всѣмъ, *by whom, by what, by that, with all the . . .*

(*h*) In all the cases of Plural of the Pronouns, тѣ, всѣ, *those, all.*

(*i*) In all the cases of Singular and Plural of the Pronouns, нѣкоторый, нѣкоторая, нѣкоторое, *someone*, and нѣсколько, *a few.*

(*j*) In the Pronouns онѣ, *they* (fem.), нѣкто, *somebody*, нѣчто, *something.*

249. Verbs ending in -ѣть retain the vowel ѣ in all the instances where the sound *ye* is heard.

250. ѣ is written in the following Adverbs and Conjunctions:—

Вóзлѣ, *near by.*	Нúнѣ, *nowadays.*
Пóслѣ, *after.*	Вполнѣ, *quite, entirely.*
Вскóрѣ, *soon.*	Покáмѣсть, *meanwhile.*
Вкрáтцѣ, *in short.*	Вмѣстѣ, *together.*
Гдѣ, *where.*	Нигдѣ, *nowhere.*
Внѣ, *outside.*	Вездѣ, *everywhere.*
Здѣсь, *here.*	Нѣкогда, *some day.*

Capitals

251. Capital letters are used on the following occasions:—

(*a*) At the beginning of a new sentence.

(*b*) After a full-stop.

(*c*) In proper names of persons.

(*d*) In geographical names, such as towns, rivers, seas, countries, states, etc.

(*e*) Titles of persons of rank, dignity, etc.

(*f*) Sacred denominations, such as divinity, holidays, etc.

(*g*) In correspondence for expressing respect, for example:—

Мúлостивый Госудáрь, *Dear Sir;* Мúлостивая Госудáрыня, *Dear Madam;* Егó Благорóдію, *His Worship;* Вы, *you;* Васъ, *you* (Acc. and Gen. case); Вамъ, *to you;* съ Вáми, *with you;* Вашъ, Вáша, Вáши, *your, yours,* etc.

(*h*) Names of firms, institutions, periodicals, books, literary works, paintings, boats, and historical events.

252. Unlike English, names of nations or adjectives of nationality, days, months, parts of the world, religions, orders and medals are written by Russians with small letters.

Abbreviations

Principal Abbreviation	*Full Term*	*English*
Анг. мил.	англíйская мúля,	*an English mile.*
Бр-ья	Брáтья,	*Brothers.*
В/.	Вашъ, Вáша, Вáше, Вáши,	*Your, yours.*
Верс.	Верстá,	*a verst* (3,500 English feet).
Верш.	Вершóкъ,	*a vershok.*
Вм.	вмѣсто,	*instead.*
г.	господúнъ,	*Mr.*
г-на	господúна,	*of Mr.*
г-ну	господúну,	*to Mr.*
г. г.	господá, господáмъ,	*Messrs., to Messrs.*
г-жа; г жѣ	госпожá; госпожѣ,	*Mrs., to Mrs.*
г.	годъ, гóда,	*a year, of, in the year.*
г.	гóродъ, гóрода, гóродѣ,	*a town, of the town, in the town.*
губ.	губéрнія,	*a province, government.*
гл.	глава́,	*a chapter.*
д.	домъ,	*a house.*
дв.	дворъ,	*the yard, court.*
д-ръ	дóкторъ,	*doctor.*
дер.	дерéвня,	*village.*
дес.	десятúна,	*a desyatin.*
дюж.	дúжина,	*a dozen.*
дюйм.	дюймъ, дюймóвъ,	*an inch, inches.*
ж. л.; жел. дор.	желѣзная, дорóга,	*railway.*
и Ко.; и Комп.	и Компáнія,	*and Co.*
им.	имѣніе,	*an estate.*
и мн. др.	и мнóгіе другíе,	*and many others.*
и пр.	и прóчее,	*et cetera.*
и т. д.	и такъ дáлѣе,	*and so on.*
и т. п.	и тому́ подóбное,	*and the like.*
испр. дол.	исправля́ющій дóлжность,	*pro tem., ad interim.*
килог.	килограмъ,	*a kilogramme.*
Килом.	Кúлометръ,	*a kilometre.*
кв.	квадрáтный,	*square.*
кл.	классъ, клáсса,	*class.*
коп.	копѣйка, копѣекъ,	*a copeck, copecks.*
куб.	кубúческій,	*cubic.*

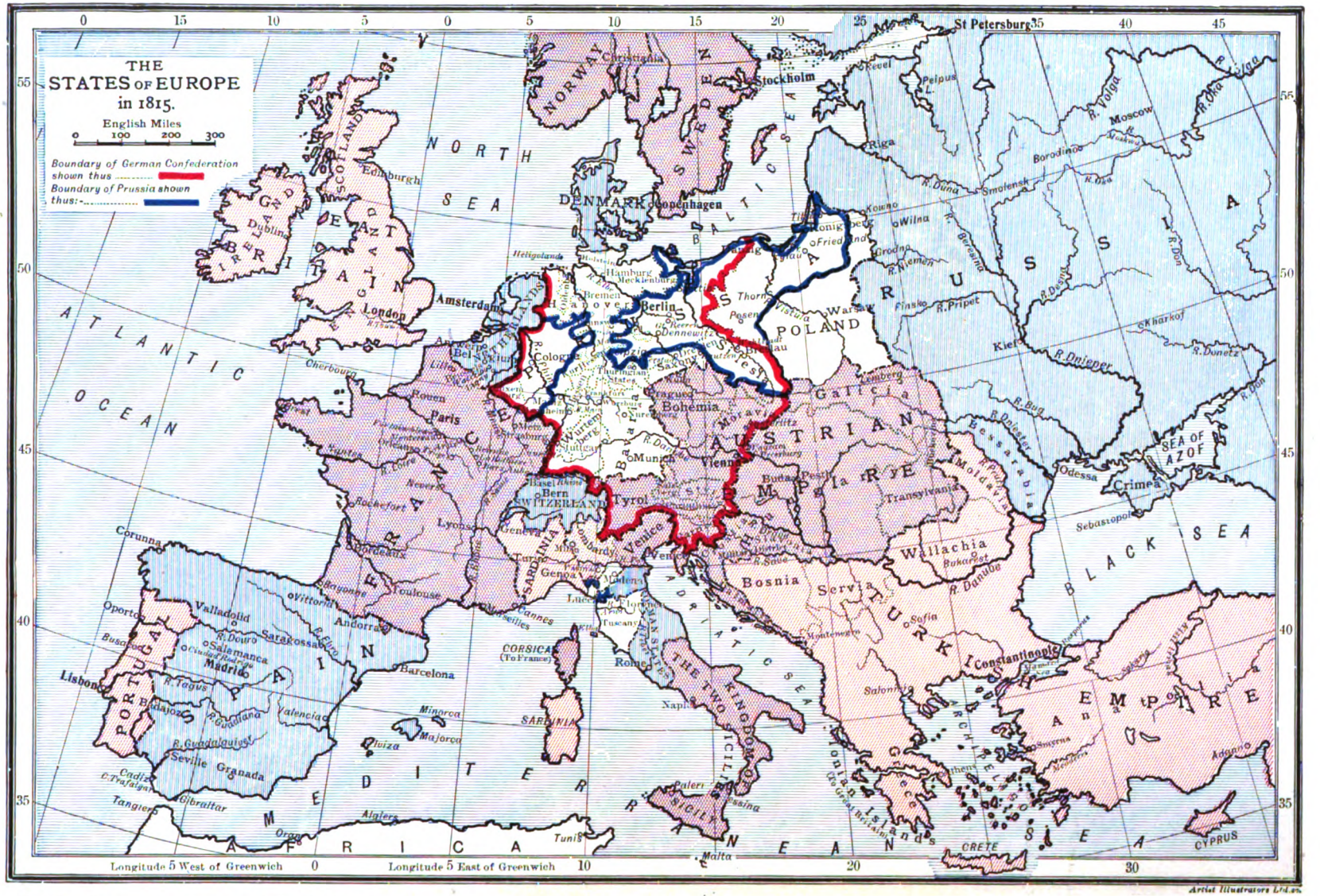
М.Г.	Ми́лостивый Госуда́рь,	*Dear Sir.*
М. Г-ня.	Ми́лостивая Госуда́рыня,	*Dear Madam.*
М. Гг.	Ми́лостивые Госуда́ри,	*Dear Sirs.*
м.	мѣсте́чко,	*small town.*
мар.	ма́рка, ма́рокъ,	*mark, marks* (German).
м/м.	ми́лиметръ,	*millimetre.*
мет.	метръ, ме́тровъ,	*metre, metres.*
м-ца	мѣсяца,	*of the month.*
м. п.	мѣсто печа́ти,	*place of affixed seal or stamp.*
мор. м.	морска́я ми́ля,	*a sea mile.*
н.	нашъ, на́ша, на́ше, на́ши,	*our, ours.*
напр.	напримѣръ,	*for instance.*
на под. под.	на по́длинномъ подписа́лъ,	*signed on the original.*
Но.; №.	но́меръ,	*number.*
н. ст.; нов. ст.	но́ваго сти́ля,	*of the new* (Gregorian) *style.*
о-во	о́бщество,	*society.*
п/п.	почтѣнное письмо́,	*esteemed letter.*
по дов.	по довѣренности,	*per pro., per procura.*
пер.	переу́локъ,	*lane, alley.*
пр/г.	про́шлаго го́да,	*last year.*
пр/м.	про́шлаго мѣсяца,	*last month.*
пуд.	пудъ, пудо́въ,	*pood, poods.*
руб.	рубль, рубле́й,	*rouble, roubles.*
руб. сер.	рубле́й серебро́мъ,	*in silver roubles.*
руб. асс.	рубле́й ассигна́ціей,	*in paper roubles.*
руб. зол.	рубле́й зо́лотомъ,	*roubles in gold.*
Р. Х.	Рождество́ Христо́во,	*in the year of grace.*
см.	смотри́,	*see, look up.*
см. на обор.	смотри́ на оборо́тѣ,	*see overleaf, next page.*
ст.	статья́,	*paragraph, article, entry.*
стр.	страни́ца,	*page.*
с/м.	сего́ мѣсяца,	*of this month.*
с/г.	сего́ го́да,	*of this year.*
с/ч.	сего́ числа́,	*of this date.*
саж.	са́жень, сажёнъ,	*a fathom, fathoms.*
съ пер.	съ пересы́лкой,	*post free, carriage paid.*
т/г.	теку́щаго го́да,	*the current year.*
т/м.	теку́щаго мѣсяца,	*instant, this month.*
т. е.	то есть,	*i.e., it is.*
Т. Д.; т. д.	Торго́вый Домъ,	*Trading House.*
т.	томъ,	*volume.*
ул.	у́лица,	*street.*
уч.	уча́стокъ,	*ward.*
фун.	фунтъ, фу́нтовъ,	*pound, pounds.*
фун. стер.	фунтъ сте́рлинговъ,	*pound sterling.*
фр.	франкъ, фра́нковъ,	*francs.*
фл.	фло́ринъ, фло́риновъ,	*florins.*
Фаб. к.	Фабри́чное клеймо́,	*trade mark.*
ц.	цѣна́,	*the price.*
ч.	часть,	*the part, district.*
ч.	число́,	*the date.*
Чис. почт. шт.	Число́ почто́ваго што́мпеля,	*post office date.*
чел.	человѣкъ,	*men* (plur.).
шт.	шту́ка, шту́ки, штукъ.	*pieces.*

40 Russian Proverbs and Adages

Russian Proverb	*Literal Translation*	*English Current Equivalent*
1. Авось задатка не даётъ.	"It might" gives no deposit.	"Perhaps" may be never.
2. Бережённаго Богъ бережётъ.	God protects the careful.	God helps those who help themselves; *or*, Help yourself, and God will help you.
3. Бочка мёду да ложка дёгтю.	A barrel of honey, and a spoon of tar.	A little bitterness spoils much sweetness; *or*, There is always a fly in the ointment.
4. Вѣкъ живи́, вѣкъ учи́сь.	The longer you live, the more you learn.	Live and learn.

Russian Proverb	*Literal Translation*	*English Current Equivalent*
5. Гласъ наро́да, гласъ Бо́жій.	The voice of the people is the voice of God.	"Vox populi, vox Dei" (Latin).
6. Горшо́къ котлу́ не това́рищъ.	Pot and kettle are no chums.	The kettle calls the pot black.
7. Де́нежки счётъ лю́бятъ.	Money likes counting.	Short reckoning makes good friends.
8. Де́ньги найду́тъ дру́га.	Money finds a friend.	Money never lacks a friend; *or*, Sugar attracts flies.
9. Дёшево да гни́ло, до́рого да ми́ло.	Cheap but foul, dear but lovely.	To buy cheap is dear in the long run.
10. Долгъ платежёмъ кра́сенъ.	Payment decorates the debt.	One good turn deserves another.
11. Дурака́мъ вездѣ́ сча́стье.	Fools have good luck.	Fortune favours fools; *or*, Providence looks after fools.
12. Дураку́ зако́нъ не пи́санъ.	There is no law written for a fool.	A fool will have his way.
13. Дѣло ма́стера бои́тся.	The work is afraid of the master.	The proof of the pudding is in the eating.
14. За пра́вое дѣло говори́ смѣло.	Speak boldly in a just cause.	Speak boldly in a just cause.
15. Знай, сверчо́къ, свой шесто́къ.	Cricket, know thy own hearth.	Mind your own business.
16. Изъ огня́ да въ полымя́.	From the fire into the flames.	To fall out of the frying-pan into the fire.
17. Изъ спаси́ба шу́бы не сошьёшь.	You cannot make a fur coat from "thank you."	Thanks do not fill a purse; *or*, Kind words butter no parsnips.
18. Какъ ау́кнется, такъ откли́кнется.	As halloed, so answered.	To give a Roland for an Oliver.
19. Льва со́ннаго не буди́.	Do not rouse the sleeping lion.	Let sleeping dogs lie.
20. На вкусъ това́рища нѣтъ.	There is no partnership in taste.	Everyone to his taste.
21. На злодѣ́ шапка гори́тъ.	The cap burns on the evildoer.	Let him whom the cap fits wear [it.
22. Нашла́ коса́ на ка́мень.	The scythe struck on a stone.	Set a thief to catch a thief; *or*, Tit for tat; *or*, Diamond cut diamond.
23. Незва́ный гость ху́же тата́рина.	An uninvited guest is worse than a Tartar.	An uninvited guest is as welcome as a dog at a wedding.
24. Оди́нъ въ по́лѣ не во́инъ.	One in the camp is no warrior (one is none).	One swallow does not make a summer.
25. Оста́тки сла́дки.	Leavings are sweet.	The last pieces are the sweetest.
26. По горшку́ и покры́шка.	Such a pot, such a lid.	As is the brain, so is the hat; *or*, From a pig you can only expect a grunt.
27 По́слѣ обѣда ло́жка.	A spoon after dinner.	To shut the stable door after the steed is stolen.
28. По пла́тью встрѣча́ютъ, а по уму́ провожа́ютъ.	One is met by his dress, and sent off by his brains.	One must not judge by first impressions.
29. Поспѣшишь, люде́й насмѣшишь.	When hastily done, people are laughing.	The more haste, the worse speed.
30. Рука́ ру́ку мо́етъ.	One hand washes the other.	Claw me, claw thee; *or*, Claw me and I'll claw thee; *or*, One good turn deserves another.
31. Рыба́къ рыбака́ ви́дитъ.	One fisherman sees the other.	One rogue knows another.
32. Семь бѣдъ, а оди́нъ отвѣтъ.	Seven misfortunes, and same response.	In for a penny, in for a pound.
33. Сидѣть у мо́ря и ждать пого́ды.	To be at the sea and wait for nice weather.	To keep one's hand in till the game begins.
34. Ско́лько голо́въ, сто́лько умо́въ.	So many heads, so many opinions.	So many men, so many minds.
35. Смѣлость города́ беретъ.	Boldness conquers cities.	Fortune favours the brave.
36. Спаси́бомъ сытъ не бу́дешь.	You cannot live on "thank you."	Thanks do not fill a purse.
37. Ста́рый другъ лу́чше но́выхъ двухъ.	One old friend is better than two new ones.	One old friend is better than two new ones.
38. Сча́стье безъ ума́—дыря́вая сума́.	Good luck without sense is a bag with holes.	Fools and their money soon part.
39. Съ покло́ну голова́ не боли́тъ.	A nod causes no headache.	Politeness costs nothing.
40. Терпи́ каза́къ, ата́маномъ бу́дешь.	Patience, Cossack, you will be a chief.	Patience brings everything about; *or*, Everything comes to him who waits.

A. C.



Showing how, upon the downfall of Napoleon, the Congress of Vienna rearranged the map which the all-conquering armies of France had left in a state of chaotic confusion (*see* **pages 134 and 135**).

GREEK.—XII

Remarks on the Contracted Verbs

THIS is the most extensive class of Greek verbs, and must be thoroughly learned. The uncontracted forms of the present and imperfect never occur in Attic Greek.

In the optative singular of verbs in -εω and -οω, the Attic forms in -οίην are to be preferred to the forms in -οῖμι, and the latter forms are very rare in verbs in -αω. The third person plural has regularly the shorter form in -ῷεν (-άοιεν).

Disyllabic verbs in -εω (as πλέω, *sail*; πνέω, *breathe*; θέω, *run*, etc.) admit only the contraction in ει (made up of εει or εε), and in all the other forms remain uncontracted, as:—

ACTIVE

Pres. Ind. πλέω, πλεῖς, πλεῖ, πλεῖτον, πλέομεν, πλεῖτε, πλέουσι.
Subj. πλέω, πλέῃς, πλέῃ, πλέωμεν, πλέητε, πλέωσι.
Imper. πλεῖ. *Inf.* πλεῖν. *Part.* πλέων, πλέουσα, πλέον.
Impf. Ind. Ἔπλεον, ἔπλεις, ἔπλει, ἐπλέομεν, ἐπλεῖτε, ἔπλεον.
Opt. πλέοιμι, πλέοις, πλέοι, etc.

MIDDLE

Pres. Ind. πλέομαι, πλέῃ, πλεῖται, πλεόμεθα, πλεῖσθον, etc.
Inf. πλεῖσθαι. *Part.* πλεόμενος. *Impf.* ἐπλεόμην.

The verb δέω, *I bind*, is exceptional, admitting contraction in all its forms—e.g., δοῦν, δοῦντος, διαδοῦμαι, κατέδουν, but not δέον, *it being necessary*, nor δέομαι, *I need*.

Several verbs in -αω depart in contraction from the ordinary rules, so that αε, αει, αη, αῃ become η and ῃ instead of α and ᾳ, as:— ζάω, ζῶ, *I live*, ζῇς, -ῇ, -ῆτον, -ῆτε; inf. ζῆν; imperat. ζῆ; imperf. ἔζων, -ης, -η, -ῆτον, -ήτην, -ῶμεν, -ῆτε, -ων. Also πεινά-ω, πεινῶ, *I am hungry*, inf. πεινῆν, etc.; διψά-ω, διψῶ, *I am thirsty*, inf. διψῆν. Further, κνάω, κνῶ, *I scratch*, inf. κνῆν; σμάω, σμῶ, *I wash*, inf. σμῆν; ψάω, ψῶ, *I rub*, inf. ψῆν; χράομαι, χρῶμαι, *I use, need*, χρῇ, χρῆται, inf. χρῆσθαι. So ἀποχρῶμαι, *I waste*, inf. ἀποχρῆσθαι; χράω, χρῶ, *I give an oracle*, χρῇς, χρῇ, inf. χρῆν.

Some verbs in -οω have an infinitive in ῶν as well as in the regular οῦν, thus ῥιγόω (ῥιγέω), *shiver*, inf. ῥιγῶν (ῥιγοῦν).

The student will have noted that in the other tenses the verbs contracting in the present and imperfect are conjugated precisely like other verbs. Being without exception verbs with vowel-stems in their original forms they have no second perfect or second aorist.

In accordance with the general rule the final vowel of the stem is lengthened in the uncontracted tenses, thus:—

ε into η, as φιλέ-ω, *love*. fut. φιλή-σω, aor. ἐφίλησα, etc.
ο ,, ω ,, μισθό-ω, *let for hire*. ,, μισθώ-σω, ,, ἐμίσθωσα, etc.
α ,, η ,, τιμᾰ́-ω, *honour*. ,, τιμή-σω, ,, ἐτίμησα, etc.

But ᾰ is lengthened into ᾱ when it is immediately preceded by ε, ι, or ρ, and sometimes ο, as:—

Ἐᾰ́ω, *allow*. fut. ἐᾰ́σω, aor. εἴᾱσα.
Μειδιᾰ́ω, *smile*. ,, μειδιᾰ́-σομαι.
Ἀλοᾰ́-ω, *strike, thresh*. ,, ἀλοᾰ́-σω.
Ἀκροᾰ́-ομαι, *hear*. ,, ἀκροᾰ́-σομαι.
Φυρά-ω, *knead*. ,, φυρά-σω.

The following with some others lengthen ᾰ to η instead of ᾱ:—

Ἐγγυᾰ́-ω, *pledge*. fut. ἐγγυή-σω.
Βοᾰ́-ω, *shout like an ox*. ,, βοή-σομαι.
Χρᾰ́-ω, *utter oracles*. ,, χρή-σω.

Observe that λούω, *wash*, forms from the simpler verb λόω the middle present λοῦται, λούμενος, λοῦ, λοῦσθαι, the imperfect ἐλούμην, ἐλοῦ, ἐλοῦτο, etc. The other parts are regularly formed from λούω.

Other verbs do not lengthen the short vowel at all, as γελάω, fut. γελάσομαι, ἀρκέω, fut. ἀρκέσομαι. In some of these verbs σ is inserted before endings with an initial μ or θ in the perfect passive of the first aorist passive, as γελάω, ἐγελάσθην; σπάω, ἔσπασμαι, ἐσπάσθην. The following are the principal verbs showing these irregularities:—

Γελᾰ́ω, *laugh*, γελάσομαι, ἐγέλασα, ἐγελάσθην.
Ἐλαύνω, (ἐλάω) *drive*, ἐλάσω (Attic ἐλῶ), aor. ἤλασα.
Κλάω, *break*, κλάσω, ἔκλασα, κέκλασμαι, ἐκλάσθην.
Περάω, *carry over*, περᾰ́σω (Attic περῶ), ἐπέρᾰσα; but περάω, *go over*, περᾰ́σω, ἐπέρᾱσα.
Σπάω, *draw asunder*, σπάσω, ἔσπασμαι, ἐσπάσθην.
Χράω, *utter oracles*, χρήσω, κέχρησμαι, ἐχρήσθην.
Αἰδέομαι, *reverence*, αἰδέσομαι, ᾐδεσμαι, ᾐδέσθην, ᾐδεσάμην.
Ἀκέομαι, *heal*, ἀκέσομαι, ἠκεσάμην, ἤκεσμαι.
Ἀλέω, *grind*, ἀλέσω (rare ἀλῶ), ἤλεσα, ἀλήλεσμαι or ἀλήλεμαι.
Ἀρκέω, *suffice*, fut. ἀρκέσω, ἤρκεσα.
Ἐμέω, *vomit*, ἐμέσω (rare ἐμῶ), ἐμοῦμαι, ἤμεσα.
Ζέω, *boil*, ζέσω, ἔζεσα.
Τελέω, *finish*, fut. (τελέσω), τελῶ, ἐτέλεσα, τετέλεσμαι, ἐτετελέσμην, ἐτελέσθην.
Χέω, *pour*, fut. χέω, ἔχεα, κέχῠκα, κέχῠμαι, ἐχῠ́θην, χυθήσομαι.
Ἀρόω, *plough*, ἀρόσω, ἤροσα, ἠρόθην.

The following in some tenses have the long vowel, in others the short one:—

Ἐπαινέω, *praise*, fut. ἐπαινέσομαι or ἐπαινέσω, aor. ἐπῄνεσα, also παραινέω, *exhort*, παραινέσω, παρῄνεσα.
Αἱρέω, *take*, αἱρήσω, ἥρηκα, ἥρημαι, ἡρέθην, αἱρεθήσομαι, 2nd aor. ἕλον, εἱλόμην.
Δέω, *bind*, δήσω, ἔδησα, ἐδησάμην, but δέδεκα (rare δέδηκα), δέδεμαι, ἐδέθην, δεθήσομαι, for which the fut. perf., δεδήσομαι, is commonly used.
Καλέω, *call*, καλῶ (rare καλέσω), ἐκάλεσα, κέκληκα, κέκλημαι, ἐκλήθην, κληθήσομαι, καλοῦμαι, aor. ἐκαλεσάμην, κεκλήσομαι.
Ποθέω, *long for*, ποθήσω, ποθήσομαι, ἔποθησα and ἐπόθεσα, πεπόθηκα, πεπόθημαι (rare ἐποθέσθην).
Πονέω, *labour*, πονήσω; but πονέσω, *I shall be in pain*; πεπόνηκα in both meanings; deponent πονεῖσθαι, *to be fatigued*, fut. πονήσομαι, etc.

The following take σ in the passive, though they lengthen the vowel:—

Πλέω, *I sail*, πλεύσομαι (πλευσοῦμαι), ἔπλευσα, πέπλευκα, πέπλευσμαι, ἐπλεύσθην.

Χράομαι, *I use*, has in the perfect middle κέχρημαι, *I have used*, but in the aorist passive ἐχρήσθην, *I was used*.

It will be a help to the learner to see these forms tabulated as follows :—

	ACTIVE		
Pres.	(Σπάω) σπῶ, *I draw apart.*	(Τελέ-ω) τελῶ, *I finish.*	(Ἀρό-ω) ἀρῶ *I plough.*
Impf.	(ἔσπαον) ἔσπων	(ἐτέλεον) ἐτέλουν	(ἤροον) ἤρουν
Fut.	σπάσω	τελῶ (τελέσω)	ἀρόσω
Aor.	ἔσπασα	ἐτέλεσα	ἤροσα
Perf.	ἔσπακα	τετέλεκα	
Plup.	ἐσπάκη	ἐτετελέκη	
	MIDDLE		
Pres.	(σπάομαι) σπῶ-μαι	(τελέομαι) τελοῦ-μαι	
Impf.	(ἐσπαόμην) ἐσπώ-μην	(ἐτελεόμην) ἐτελού-μην	
Fut.	σπάσομαι	τελοῦμαι	
Aor.	ἐσπα-σά-μην	ἐτελεσάμην	
Perf.	ἔσπα-σ-μαι	τετέλεσμαι	
Plup.	ἐσπά-σ-μην	ἐτετελέσμην	
	PASSIVE		
Aor.	ἐσπάσθην	ἐτελέσθην	ἠρόθην
Fut.	σπασθήσομαι	τελεσθήσομαι	
Verbal Adjectives	σπαστέος	τελεστέος	ἀροτέος

There also is an example of a verb κελεύω, *command*, inflected in the perfect middle passive, etc., showing the σ inserted before the personal endings:—

		Indicative.	*Imperative.*
Sing.	1.	Κε-κέλευ-σ-μαι	
	2.	Κε-κέλευ-σαι	κε-κέλευ-σο
	3.	Κε-κέλευ-σ-ται	κε-κελεύ-σθω
Dual	2.	Κε-κέλευ-σ-θον	κε-κέλευ-σθον
	3.	Κε-κέλευ-σ-θον	κε-κελεύ-σθων
Plur.	1.	Κε-κελεύ-σ-μεθα	
	2.	Κε-κέλευ-σθε	κε-κέλευ-σθε
	3.	Κε-κελευ-σ-μένοι εἰσί	κε-κελεύ-σθωσαν

Pluperfect.

Sing. 1. Ἐ-κε-κελεύ-σ-μην
2. Ἐ-κε-κέλευ-σο
3. Ἐ-κε-κέλευ-σ-το

Dual 2. Ἐ-κε-κέλευ-σ-θον
3. Ἐ-κε-κελεύ-σ-θην

Plur. 1. Ἐ-κε-κελεύ-σ-μεθα
2. Ἐ-κε-κέλευ-σθε
3. Ἐ-κε-κελευ-σ-μένοι ἦσαν

AOR. PASS. Ἐκελεύ-σ-θην

FUT. PASS. Κελευ-σ-θήσομαι

THE ATTIC FUTURE

In the future active and middle of καλέω, *call*, and τελέω, *finish*, the σ is dropped and the ε of the stem contracts with ω and ομαι, forming the termination -ῶ and -οῦμαι, as follows :—

Καλέω, *call*, καλέσω (καλέω), Attic καλῶ, -εῖς, -εῖ, -οῦμεν, -εῖτε, -οῦσι ; καλέσομαι, καλοῦμαι, -ῇ, -εῖται, etc.

Τελέω, *finish*, τελέ-σ-ω, Attic τελῶ, -εῖς, -εῖ, -οῦμεν, -εῖτε, -οῦσι ; τελέ-σ-ομαι, τελοῦμαι, -ῇ, -εῖται, etc.

So also ἐλαύνω (poet. ἐλάω), *drive*, (ἐλάσω), ἐλῶ, ἐλᾷς, ἐλᾷ, ἐλῶμεν, ἐλᾶτε, ἐλῶσι(ν).

Similarly, verbs in -ιζω of more than two syllables regularly drop σ in the future and insert ε, thus :—

Κομίζω, *carry*, κομίσω, Attic (κομιέω) κομιῶ, -ιεῖς, -ιεῖ, -ιοῦμεν, -ιεῖτε, -ιοῦσι ; κομίσομαι, Attic (κομιέομαι), κομιοῦμαι, -ιεῖ, -ιεῖται, -ιούμεθα, etc.

In the same way, verbs in -αζω drop σ in the future, the -αω contracting to -ῶ, thus :—

Βιβάζω, *make to go*, βιβάσω (βιβάω), βιβῶ, βιβῶμεν, etc.

An example of the way in which contracted verbs are conjugated is subjoined below. This should be carefully committed to memory exactly as it is given here :—

Τιμάω, τιμῶ ; τιμάεις, τιμᾷς ; τιμάει, τιμᾷ ; τιμάετον, τιμᾶτον ; τιμάετον, τιμᾶτον ; τιμάομεν, τιμῶμεν ; τιμάετε, τιμᾶτε ; τιμάουσι, τιμῶσι.

Τιμάομαι, τιμῶμαι ; τιμαέσθω, τιμάσθω ; μισθοέσθων, μισθούσθων ; φιλεόμενος, φιλούμενος ; ἐφιλεόμεθα, ἐφιλούμεθα ; ἐτιμάεσθε, ἐτιμᾶσθε ; ἐφιλέοντο, ἐφιλοῦντο, etc.

VOCABULARY

ἀκέομαι, *heal.*
ἀκολουθέω, *follow*, (usually with dat.).
ἄκρα, -as, ἡ, *summit, citadel.*
ἀξιόω, *deem worthy* (of).
αὐτονομία, -as, ἡ, *self-government, independence.*
αὔριον, *to-morrow.*
βασιλεία, ἡ, *monarchy, kingdom.*
δῆμος, ὁ, *people, democracy.*
ἕλκος, -ους, τὸ, *wound.*
ἐμφυτεύω, *implant.*
ἐπιθυμία, ἡ, *desire.*
ἰατρός, οῦ, ὁ, *physician.*
κατακλείω, κλείσω, κέκλεισμαι, *shut up.*
κρύπτω, *conceal.*
κτάομαι, *gain, acquire.*
κέκτημαι, *possess.*
μετέπειτα, *afterwards.*
οἶνος, ὁ, *wine.*
παιδεύω, *educate, instruct.*
στρατία, -as, ἡ, *army.*

Exercise 12

(*a*) Translate into English :—

1. Οἱ γενναῖοι νεανίαι τῇ ἀρετῇ ἀκολουθήσουσιν. 2. Οἱ πολῖται τὸν στρατηγὸν μεγάλης τιμῆς ἠξίωσαν. 3. Οἱ ἰατροὶ τὸ ἕλκος ἠκέσαντο. 4. Οὐδεὶς ἔπαινον ταῖς ἡδοναῖς κτήσεται. 5. Ἤν σὺ κακῶς δικάσῃς, Θεὸς σὲ μετέπειτα δικάσει. 6. Ἡ ἐπιστολὴ ὑπὸ τοῦ παιδὸς γέγραπται.

(*b*) Translate into Greek :—

1. The monarchy has been destroyed by the people. 2. Let good counsel be taken before acting (the deed). 3. The desire of self-government is implanted in all men. 4. Let the door be shut. 5. The enemy are said to have been shut up in the citadel. 6. The oxen are said to have been shut up.

Key to Exercise 10

(*a*) 1. The soothsayer sacrificed to the god. 2. The soothsayer has sacrificed a hundred oxen to the god. 3. Alexander had destroyed Babylon. 4. That man is poor, and has few friends. 5. Women are beautiful when they have good sense. 6. The young man is ignorant of music.

(*b*) 1. Ὁ πολίτης φυλάττει τοὺς νόμους. 2. Αὕτη ἡ ὁδὸς πρὸς τὴν πόλιν ἄγει. 3. Ὁ πατὴρ ἐμοῦ προνοίαν ἔχει τῆς ἐμῆς παιδείας. 4. Αὗται αἱ παῖδες μουσικῆς ἀπείρως ἔχουσι. 5. Δύο ἀνθρώπω ἀποφεύγετον. 6. Ἀλέξανδρος Βαβυλῶνα κατέλυσεν.

Key to Exercise 11

(*a*) 1. God has hidden the future from men. 2. The soldiers left the ranks. 3. Those who do wrong are wronged themselves. 4. They fear death, the termination of evils. 5. The citizens fear lest the city may be besieged. 6. Bad men are enslaved to the flesh.

(*b*) 1. Ὁ παῖς τὴν μητέρα ἀγαπᾷ. 2. Ὁ στρατηγὸς νικᾷ πάντας τοὺς πολεμίους. 3. Οἱ ἀγαθοὶ παῖδες τοὺς γονέας ἀγαπῶσι. 4. Ἐκεῖνοί σε ὀρῶσι. 5. Σὺ πάντας ἀγαπᾷς. 6. Μή σε νικάτω κέρδος.

E. A. B.

ITALIAN.—XIV

Imperative Mood.—This mood expresses command and has only the present tense, as in English. It has no first person singular. Its endings are derived from the Present Indicative and Present Subjunctive, as shown below.

There are two distinct forms of the Imperative Mood, the Affirmative and the Negative forms.

Affirmative Form:

Sing.

1. (None).
2. Like 2nd Pers. sing. Pres. Ind.
3. Like 2nd Pers. sing. Pres. Subj.

Plur.

1. Like 1st Pers. pl. Pres. Ind.
2. Like 2nd Pers. pl. Pres. Ind.
3. Like 3rd Pers. pl. Pres. Subj.

Exception: 2nd singular Affirmative Imperative of 1st Conjugation is like 3rd singular of Present Indicative.

The Negative Form is derived entirely from the Present Subjunctive, except the 2nd person singular, which is simply the *Infinitive* preceded by **non.**

Avere, *to have* (irreg.)	**Éssere,** *to be* (irreg.).
abbi, *have* (thou)!	sii, *be* (thou)!
non avere, *do not* (thou) *have!*	non éssere, *do not* (thou) *be!*
abbia, *let him have!*	sía, *let him be!*
abbiamo, *let us have!*	siamo, *let us be!*
abbiate, *have* (you)!	siate, *be* (you)!
ábbiano, *let them have!*	síano, *let them be!*

The Imperative Mood of the Regular Conjugations, *I buy*, etc., is as follows:—

Comprare.	**Véndere.**	**Partire.**	**Finire.**
	Sing.		
compra	vendi	parti	finisci
non comprare	non véndere	non partire	non finire
compri	venda	parta	finisca
	Plur.		
compriamo	vendiamo	partiamo	finiamo
comprate	vendete	partite	finite
cómprino	véndano	pártano	finíscano

When *let* means *permit, allow*, it is rendered by **lasciare.**

Examples:—

Lasciate entrare quel signore!	*Let that gentleman come in!*
Dátemi la mano, ve ne prego, e abbiate la bontà di fare in maniera che nessuno vi veda (*or* vegga).	*Give me your hand, I beg of you* (lit. I pray you of it), *and have the goodness to act so* (in manner) *that no one sees* (may see) *you.*
Scrivétemelo e spiegátemelo chiaramente!	*Write it to* (*or* for) *me and explain it to me clearly.*
Lasciate ch'io vi dica una cosa!	*Let me tell you something!*
Pórtino la pólizza di cárico con sè!	*Let them bring* (take) *the bill of lading with them!*
Portate ciò che (quel *or* quello che) domandiamo!	*Bring what* (that which) *we ask for.*
Domándino tutto quello (quel) che vógliono!	*Let them ask for all they want!*
Offrítegli un sígaro, ve ne prego!	*Offer him a cigar, please.*
Mío figlio, non éssere (2nd sg. neg. imperat.) cosí impaziente! Sii contento e abbi un po' (poco) più di pazienza, te ne prego!	*My son, do not be so impatient, be content, and have a little more patience, do!*
Non mangiate troppo, sarete ammalato!	*Do not eat too much, you will be ill!*
Sappiate (sappi, 2nd sg.). che non vogliamo cédere!	*Know that we are not willing to yield.*
Non dimenticate di far quello (ciò) che vi ho detto!	*Do not forget to do what I told you.*
Non tema che piova!	*Do not let him fear* (Let him not fear) *that it will rain.*
Dáteci a mangiare e a bere!	*Give us something to eat and drink.*
Quando lo vedrete, dítegli che non dúbito e non nego che non sía capace di fare quel che dice.	*When you see* (will see) *him, tell him that I do not doubt and do not deny that he is capable of doing what* (that which) *he says.*

After verbs of doubt, denial, etc., used negatively or interrogatively, **non** precedes the subjunctive verb in the subordinate sentence. Those who have followed the French course will be familiar with this type of construction.

Vádano súbito alla stazione, domándino quando partirà il treno per Nápoli e préndano due biglietti per quella città.	*Let them go at once to the station, let them ask when the train will leave for Naples and let them take two tickets for that town.*

Non dúbito che non abbiate fatto il vostro possíbile.	*I do not doubt that you have done your best.*
Vi ho scritto questa léttera affinchè siate convinti (pl.) della mía innocenza.	*I have written this letter in order that you may be convinced of my innocence.*
Témono ch'io non li capisca.	*They fear that I may not understand them.*
Dítelo senza ch'egli lo sáppia.	*Say it without that he may know it* (without his knowing it).
Pretende che sía il primo che l'abbia saputo.	*He pretends* (claims) *that he is* (be) *the first* (a kind of superlative) *who has known it.*

Cardinal Numbers: These are enumerated as follows :—

1	*un, un', uno, una*	22	ventidúe
2	*due*	23	ventitre
3	*tre*	24	ventiquattro
4	*quattro*	30	*trenta*
5	*cinque*	31	trentuno
6	*sei*	32	trentadúe
7	*sette*	40	*quaranta*
8	*otto*	50	*cinquanta*
9	*nove*	60	*sessanta*
10	*dieci*	70	*settanta*
11	*úndici*	80	*ottanta*
12	*dódici*	90	*novanta*
13	*trédici*	100	*cento*
14	*quattórdici*	101	centuno
15	*quíndici*	200	duecento
16	*sédici*	201	duecentuno
17	*diciassette*	300	trecento
18	*diciotto*	1,000	*mille*
19	*diciannove*	2,000	*duemila*
20	*venti*	100,000	centomila
21	*ventuno*	1,000,000	*un milione*

(Only the numbers printed in italic type need be learned by heart, the others being compounds.)

The names of the days and months are given below. It will be interesting to the student who has learnt French to compare the Italian days and months with their French equivalents.

doménica, *Sunday*
lunedì, *Monday*
martedì, *Tuesday*
mercoledì, *Wednesday*
giovedì, *Thursday*
venerdì, *Friday*
sábato, *Saturday*

gennáio, *January*
febbráio, *February*
marzo, *March*
aprile, *April*
mággio, *May*
giugno, *June*
lúglio, *July*
agosto, *August*
settembre, *September*
ottobre, *October*
novembre, *November*
dicembre, *December*

VOCABULARY

la storia, *story, tale.*
la bugía, *falsehood, fib, lie.*
la buca per le léttere, *letter-box.*
scoprire, *to find out, discover.*
dappertutto, *everywhere.*
il mascalzone, *rascal.*
vicino, *near, neighbouring.*
gettare, *to throw, post.*
dentro, *within.*
la cartolina postale, *post-card.*
fumare, *to smoke.*
guardare, *to look at.*
il coraggio, *courage.*
arrivare, *to happen.*
sedere, *to sit.*
ascoltare, *to listen to.*
narrare, *to narrate.*
firmare, *to sign.*
l'abitúdine (*f.*), *habit.*
triplicato, *triplicate.*
puntualmente, *punctually.*
l'assioma (*m.*), *axiom.*
sedersi, *to seat oneself, sit down.*

Exercise 27

Translate into English :—

1. Porti (polite form) queste léttere alla posta ! 2. Dátegli il mío indirizzo, ve ne prego. 3. Abbiate la bontà di dirmi quando potrò vedervi di nuovo. 4. Non credete le súe storie, sono bugíe ! 5. Cercate la buca più vicina per le léttere e gettate dentro questa cartolina postale ! 6. Quando arriverà il visitatore che aspettiamo, lasciátelo entrare súbito. 7. Finisca (polite form) il súo lavoro e allora potrà andársene. 8. Non dimenticate di fermare la porta ! 9. Dícano quel che vógliano, non usciremo ! 10. Non lasciate fumare gl'impiegati nelle ore del lavoro.

Exercise 28

Translate into Italian :—

1. Let them go to the lawyer and let them narrate to him the whole story. 2. Let us finish all our correspondence before going away. 3. Let him write to them and explain to them all the affair. 4. Speak to me and tell me all you have done ! 5. Give him something to eat and drink. 6. Do not go to the station before seeing me. 7. Go at once to the printer and tell him that we must (dobbiamo) have the goods in (fra) an hour. 8. Please sign this letter and these bills. 9. Make out (omit) the invoice and put (throw) it into the nearest letter-box. 10. My son, do not lose so much time ! Be diligent, do !

Key to Exercise 25

1. We do not claim to be the first who have known of this invention. 2. I request you to tell him without their knowing it. 3. Whether he says it or not does not matter to me at all ; I do not fear his knowing it. 4. If they do not wish me to do it, let them tell me so frankly so that I may know what to do. 5. If you see him, have the goodness to tell him everything just as I have explained it to you. 6. They have told them plainly : " If you do not wish us to do it, do it yourselves ! " 7. He is writing that letter to them in order that they may be in a position to execute the order properly. 8. They are looking out for two clerks who, together with experience in business, have a knowledge of English, German, Italian, and French.

Key to Exercise 26

1. Siam lieti (contenti) che ábbiano trovato (trovate) le qualità che vogliamo, e daremo loro un órdine considerévole. 2. Io sono sorpreso che non abbiate saputo della invenzione della quale tutti párlano. 3. Se lúi non vuole che loro lo fácciano per lúi, che egli se lo faccia stesso, e allora sarà soddisfatto (contento). 4. Cerchiamo un cassiere che sía capace di occupare questo posto (impiego). 5. Ho un cassiere che è capace di fare tutto ciò (quello) che lo prego di fare. 6. Che lo diciate o no, non c'importa ; noi volevamo soltanto fare ciò (quello) che è giusto. 7. E impossíbile che arriviate alla vostra destinazione prima di mezzanotte, se partite oggi a mezzogiorno.

A. C.

SPANISH.—XIV

The Verb. Irregularities.—The principal irregularities in the Past Definite Indicative are :—

andar, *to go*	anduve	anduviste	anduvo	anduvimos	anduvisteis	anduvieron.
caber, *to be contained, to find room*	cupe	cupiste	cupo	cupimos	cupisteis	cupieron.
conducir, *to conduct* (and all verbs ending in **ducir**)	conduje	condujiste	condujo	condujimos	condujisteis	condujeron.
dar, *to give*	dí	diste	dió	dimos	disteis	dieron.
decir, *to say*	dije	dijiste	dijo	dijimos	dijisteis	dijeron.
dormir, *to sleep*	dormí	dormiste	durmió	dormimos	dormisteis	durmieron.
erguir, *to erect*	erguí	erguiste	irguió	erguimos	erguisteis	irguieron.
estar, *to be*	estuve	estuviste	estuvo	estuvimos	estuvisteis	estuvieron.
haber, *to have*	hube	hubiste	hubo	hubimos	hubisteis	hubieron.
hacer, *to do, make*	hice	hiciste	hizo	hicimos	hicisteis	hicieron.
ir, *to go*	fuí	fuiste	fué	fuimos	fuisteis	fueron.
morir, *to die*	morí	moriste	murió	morimos	moristeis	murieron.
pedir, *to ask*	pedí	pediste	pidió	pedimos	pedisteis	pidieron.
poder, *to be able*	pude	pudiste	pudo	pudimos	pudisteis	pudieron.
poner, *to put*	puse	pusiste	puso	pusimos	pusisteis	pusieron.
querer, *to wish*	quise	quisiste	quiso	quisimos	quisisteis	quisieron.
reir, *to laugh*	reí	reiste	rió	reímos	reisteis	rieron.
saber, *to know*	supe	supiste	supo	supimos	supisteis	supieron.
satisfacer, *to satisfy*	satisfice	satisficiste	satisfizo	satisficimos	satisficisteis	satisficieron.
sentir, *to feel, to be sorry*	sentí	sentiste	sintió	sentimos	sentisteis	sintieron.
ser, *to be*	fuí	fuiste	fué	fuimos	fuisteis	fueron.
tener, *to have*	tuve	tuviste	tuvo	tuvimos	tuvisteis	tuvieron.
traer, *to carry*	traje	trajiste	trajo	trajimos	trajisteis	trajeron.
venir, *to come*	vine	viniste	vino	vinimos	vinisteis	vinieron.
ver, *to see*	ví	viste	vió	vimos	visteis	vieron.

The following paradigm represents an irregular verb complete in all its moods and tenses, together with the negative imperative, which is always taken from the present subjunctive.

Poner. *Present Participle* (**Gerund**): poniendo
Past Participle: puesto

Pres. Ind. :	pongo	pones	pone	ponemos	ponéis	ponen.
Impf. Ind. :	ponía	ponías	ponía	poníamos	poníais	ponían.
Past Def. :	puse	pusiste	puso	pusimos	pusisteis	pusieron.
Future :	pondré	pondrás	pondrá	pondremos	pondréis	pondrán.
Cond. Ind. :	pondría	pondrías	pondría	pondríamos	pondríais	pondrían.
Pres. Subj. :	ponga	pongas	ponga	pongamos	pongáis	pongan.
Impf. Subj. :	pusiese	pusieses	pusiese	pusiésemos	pusieseis	pusiesen.
Fut. Subj. :	pusiere	pusieres	pusiere	pusiéremos	pusiereis	pusieren.
Cond. Subj. :	pusiera	pusieras	pusiera	pusiéramos	pusierais	pusieran.
			Imperative			
Affirmative :	——	pon	ponga	pongamos	pongáis	pongan.
Negative :	——	no pongas	no ponga	no pongamos	no pongáis	no pongan.

This present participle has become obsolete in many verbs, or is now used to form other parts of speech, as the preposition durante, *during*, mediante, *by means of*, etc.

The real present participle ends in **-nte**, and is used as an adjective, as—

Ella es muy **amante** de la música.
She is a great lover (one who *is liking*) *of music.*

Son muy **obedientes** á las órdenes del jefe.
They are very obedient to the orders of the principal.

Vendemos artículos **provenientes** de diversos mercados.
We sell goods coming from various markets.

Las casas **tratantes** en lanas han hecho buenos negocios durante este año.
The firms dealing in wool have done good business during this year.

The term "gerund" will be used in this work in future to signify the verbal present participle, ending in **-ndo** which denotes the action only and is invariable, as—

Los socios, creyendo que no había posibilidad de más ganancia, se decidieron á abandonar aquel mercado.
The partners, thinking there was no possibility of any more profit, decided to abandon that market.

VOCABULARY

la orden, *the order.*
la prosperidad, *the prosperity.*
hasta, *as far as.*
desempeñar, *to execute.*
satisfactoriamente, *satisfactorily.*
el conocimiento, *the bill of lading.*
hacer presente á alguno, *to put a fact before anyone.*
apoyar, *to support, back up.*
la acción, *the action.*
vario, *different, various.*
de consideración, *important.*
¿ porqué ? *why ?*
otra vez, *again.*
el importe, *the amount.*
el paseo, *the walk.*
corto, *short.*
el cansancio, *the fatigue.*
la Compañía (Cía.), *the Company.*
el ignorante, *the ignoramus.*
la voluntad, *the intention.*
comprender, *to understand.*
el dolor, *the pain.*
agudo, *acute.*
el brazo, *the arm.*
enseguida, *at once.*
el médico, *the doctor.*
el esfuerzo, *the effort.*
reproducir, *to reproduce.*
al fin y al cabo, *at the end of all.*
reírse de, *to laugh at.*
ambos, *both.*
reír á carcajada tendida, *to guffaw.*
el kilómetro, *the kilometre.*
á pie, *on foot.*
el mozo, *the waiter.*
el vino, *the wine.*
beber, *to drink.*
el deudor, *the debtor.*
en fin, *at last.*
hacer frente á, *to meet* (obligations).
la obligación, *the obligation.*
estar muy acreditado, gozar de muy buena reputación, *to enjoy a good reputation.*
la plaza, *the place, the market.*
la ley, *the law.*
el habitante, *the inhabitant.*
el país, *the country.*
prosperar, *to prosper.*
las operaciones, *the transactions.*
respecto á, *in the way of.*
pronto, *promptly.*
le ejecución, *the execution.*
el peso neto (líquido), *the net weight.*
el peso bruto, *the gross weight.*
poner un cable, *to send a cable.*
escandaloso, *scandalous.*
único, *only.*
en este particular, *about this matter.*
soportar, *to bear.*
la consecuencia, *the consequence.*
nada, *not anything, nothing.*
tanto (tan), *such* (a).
la cabeza, *the head.*
así que, de modo que, de manera que, con que, *so that.*
algo de serio, *anything serious.*
tal cual, *exactly.*
obtener, *to obtain.*
bonito, *very nice.*
la utilidad, *the profit.*
hacer sus posibles, *to do one's best.*
más tarde, *later.*
la vez, *the time.*
los tipos malcriados, *the ill-bred fellows.*
tropezar, *to stumble.*
el lodo, *the mud.*
el lugar, *the space, the room.*
hermoso, *pretty, nice.*
el armario de libros, *the bookcase.*
el lado, *the side.*
andar, *to walk, to go.*
treinta, *thirty.*
la milla, *the mile.*
más temprano, *earlier.*
la tarde, *the afternoon.*

Exercise 25

Translate into English :—

1. Obedientes á las leyes, han tenido estos fabricantes mucha prosperidad durante los últimos años. 2. Me dió la mano y me dijo : " Ha hecho V. muy bien y ahora ¡ duerma V. en paz ! " 3. El cliente me condujo hasta la casa de su amigo á quien pedí explicaciones de todo lo que se había hecho. 4. Puse en juego todas mis fuerzas para desempeñar satisfactoriamente el pedido. 5. Pondremos en el conocimiento las dos cajas de muestras. 6. ¡ Póngame V. un telegrama así que llegue á su destino ! 7. Yo le hice presente que no quería apoyarle en tal acción. 8. Fuimos á ver á varios clientes de quienes conseguimos pedidos de consideración. 9. Satisficimos á Vs. á vuelta de correo y no sabemos porqué nos piden otra vez dicho importe. 10. Al oír esto V. supo todo y es inútil ahora hacer el ignorante.

Exercise 26

Translate into Spanish :—

1. Everything coming from (Todo lo proveniente de) the firm (of) Jackson and Co. enjoys a good reputation in this market (plaza). 2. Obedient to the laws of a good government, the inhabitants of this country have prospered much in their business transactions. 3. What did they say when they gave you the letter ? 4. We conducted our client to the warehouses of various manufacturers and showed him everything there was (of) new in the way of designs in the place (plaza). 5. Put (pl.) forth (poner en juego) all your efforts in order to give prompt execution to our order. 6. We put in the invoice the net and gross weights of the packages when we made the sending. 7. If I should make (Cond. Subj.) an arrangement with him, I should send (put) you a cable the same day. 8. Put before him the fact (Hacerle presente) that I am not ready to back up (apoyarle) his friend in such scandalous conduct. 9. They were the only persons that we went to see about this matter. 10. Satisfy us by return of post or we shall get (hacer) the bill protested and you will have to bear the expense (los gastos) and all the consequences.

Key to Exercise 19

1. We shall tell the cashier to go to the Bank and to say everything about this business. 2. I shall come to-morrow and explain it to you, so that you may know how things are going. 3. Come (pl.) and see me oftener and give me all the news. 4. We should like those customers to come to our town twice each year. 5. What would you do in my place and what would you wish me to do ? 6. We shall put the books in order for the visit of the auditors. 7. Not the half of these pieces of furniture would go into our office. 8. Our traveller will go out at the beginning of next year. 9. It would not be worth while spending so much time on such trifles. 10. He can (will be able to) tell you it when he is in your town. 11. We should only know what to do if you told (it) us. 12. I confess it is impossible that he should be the same man. 13. Do you remember this circumstance ? 14. It is better that we should not enter into such speculations, in order that we may sleep in peace. 15. It is possible that the firm mentioned enjoys much confidence in the market.

Key to Exercise 20

1. En caso que las (libranzas) venzan antes de mi regreso, póngame V. un telegrama una semana antes de su vencimiento. 2. Estos son los nuevos dibujos, escojan Vs. los que les gustan mejor. 3. Le diré á él que pida á sus clientes (que) acepten los géneros. 4. ¡Que no haya confusión en este asunto ! 5. No querrá V. negocios que conduzcan á reclamaciones. 6. Que conozca ó no á esta persona, que le dirija la carta. 7. Vengo á pedirles á Vs., Señores, que contribuyan á esta obra tan buena. 8. En vez de contestarme con cortesía, sólo gruñó. 9. Es menester que V. distinga entre estas dos cosas. 10. Paguemos nuestras deudas, para que durmamos en paz. 11. Saqué el giro con este vencimiento, de suerte que V. aproveche el plazo largo que tiene que correr la letra (libranza). 12. No creyendo que fuese (fuera) el mismo dibujo, yo no quería aceptar los géneros.

A. C.

Continued from Vol. V., page 476.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

EUROPE.—III

In the way of communications Europe, as is only to be expected, is the best served of all the continents. The network of railways is at its densest in the centre. But it may be said that there is railway communication between practically every important centre between Lisbon in the west and the Russian frontier on the furthest east, and between Finland in the north and Constantinople in the south.

Railways and—

There are two railways which now link up the European systems with those of other continents. The first of these is the trans-Siberian railway which runs from Russia across Siberia, and, entering China, has its far eastern terminus on the Pacific coast. The second line is the one which, although the continuous communication is broken by water, runs to the south-east into Asia, and has its present terminus a few miles beyond Baghdad. This railway, as a matter of fact, was largely relied on by the Germans to assist their schemes of military and commercial conquest in the east.

Russia owns the longest length of railway line of any of the European countries, possessing as she does about thirty-eight thousand miles in Europe in addition to those in her Asiatic territories (eleven thousand). Germany comes second, claiming forty thousand miles of line, but, of course, being without any extensions into the neighbouring continent.

France owns a length of about thirty thousand miles. After this there is a considerable drop, the Italian lines, which come next in importance, only just exceeding eleven thousand miles, the Spanish and Swedish totals being just a little below this again.

It may be said of the European lines in general that the tendency is to accelerate the time of the journeys by a continuous improvement in the chosen routes. This, of course, is only made possible by the advance of modern science which has permitted the giant tunnellings in the Alps, and the employment of railway ferries across the Baltic and the English Channel. The former carry the trains from northern Germany to Sweden. This feat is greatly facilitated by the almost tideless state of the Baltic; the marked rise and fall of the sea on our own coasts renders the operation rather difficult, but during the Great War, the Richborough Ferry was efficiently worked.

—Canals

It stands to reason that in mountainous countries no extensive system of canalisation is to be looked for, and thus in Spain and Portugal no notable examples of these convenient waterways are met with. France, on the other hand, has a very complete network of canals.

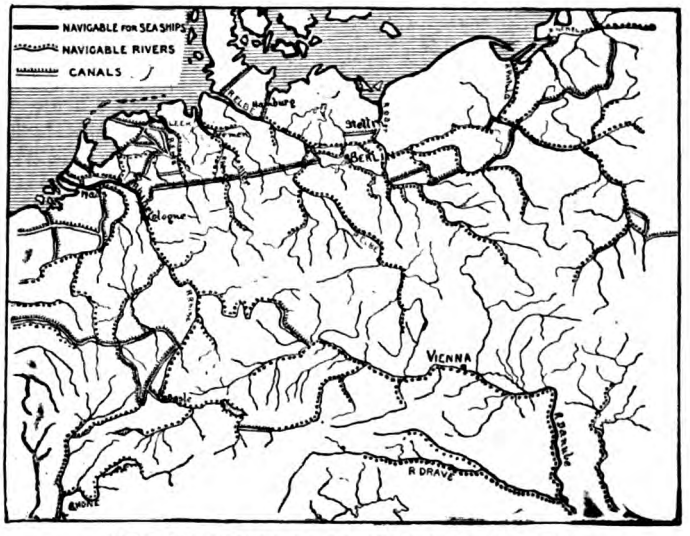
The northern part of France is especially well served in this respect, and the system here is linked up with those of Belgium, Holland and Germany. By this means it is possible to journey by water from the north of France across Europe, eventually joining the Danube and emerging into the waters of the Black Sea in the far south-east.

A comparatively short but very important French canal is the Canal du Midi, which permits barges to proceed from the Mediterranean shore to the upper waters of the Garonne River, and thus permits a direct water transit between the Mediterranean and the Bay of Biscay, which otherwise could not be accomplished save by a complete circumnavigation of the Iberian Peninsula, a journey that is clearly beyond the powers of canal craft.

Germany's system of canals is far less complete than that of France. The great rivers which traverse her territories, however, are joined together by canals, one of the most important of which is the Ludwig's Canal, which joins the tributaries of the

Main and the Danube. The German rivers, moreover, are connected by canal with the Rhone and the Seine in France, and with the Vistula in Russia. One of the most important achievements of the Germans in this direction is, undoubtedly, the Kiel Canal in the north. This enterprise was carried through largely, of course, on account of the military advantages it offered, and its strategic value was proved in the course of the war.

The canals of Belgium are extensive and well planned, a great part of the country being low-lying, and thus well adapted to canalisation. The canal country *par excellence* of Europe, however, is its neighbour, Holland. The Dutch canals have been famous now for many centuries, and indeed the maze of waterways which covers the land is perfectly astounding.



THE WATERWAYS OF CENTRAL EUROPE.

The general type of the Dutch country closely resembles that of our Eastern county fens, and the traveller is afforded the same curious spectacle of sailing wherries and barges apparently proceeding on their way across the soil of meadows. The illusion is brought about by the low-lying ground, which is frequently beneath the level of the waters. To such an extent is this the case in Holland that a part of the military scheme for the defence of the country consists in flooding large areas of land, and thus rendering them impassable by the enemy.

Denmark owns a useful system of canals, and the south of Sweden is well served in this way, the most important of the Swedish waterways being the Gotha Canal. The remaining parts of both Sweden and Norway are too mountainous to permit of canals.

The Russian canals are of considerable importance, the Volga and the Neva being connected by this means. There are waterways, too, which connect the Dnieper with the Dwina, the Niemen and the Bug.

The numerous mountainous districts of Austria and Hungary have not permitted very extensive canalisation, and this condition of affairs applies with much greater force in Turkey, the Balkan countries, and Greece, in all of which lands canals may practically be said to have no existence.

Italy, on the other hand, possesses some good canals in her northern provinces, some of which are adapted for the transit of fairly important vessels.

Primitive Transport

To return once again to the subject of land transport, it may be said that there is scarcely a country in Europe that is not now beginning to adapt its highways to the requirements of the motor vehicle, the importance of which in all matters of transport is becoming more marked every year.

Of the older-fashioned methods of industrial transport which survive that of the ox-cart is largely employed in the Iberian Peninsula, the South of France, Italy and in south-eastern Europe in general. The reindeer sledges that obtain in a few of the most northern districts of the continent are picturesque, but can scarcely be considered as typical of European transport in any practical sense.

In dealing with the principal ports of Europe we may start from the north-east, and circumnavigate the continent—or at least as much of the continent as permits itself to be circumnavigated—from east to west.

Following this route we arrive first of all at the bleak northern coast of Russia. The chief port here is that of Archangel on the White Sea. Archangel is icebound during the winter, and it is only during the summer months that it is enabled to deal with the furs, tallow, fish, and other northern products of which it constitutes the outlet. For the western Russian ports it is necessary to pass across Lapland and to proceed

southward by the side of the Gulf of Bothnia towards the Baltic Sea. By this means we arrive at the fine town of Petrograd. It, too, is icebound for part of the year. In its neighbourhood is the strongly fortified port of Cronstadt. The water between the two is shallow, and a channel has had to be dredged for the passage of larger vessels.

The last Russian port of importance on this coast is Riga, on the Gulf of Riga, an inlet of the Baltic Sea. This place is concerned with shipbuilding and with the export of great quantities of timber as well as other produce, but its harbour suffers from the same disadvantages as Archangel and Petrograd, and can receive shipping only during the summer.

Before emerging into the open ocean it will be as well to conclude with the ports of the inland northern seas. On the Prussian coast is the large port of Königsberg, one of the most notable of those concerned with the Baltic trade. Dantzig lies to the west of this, while at the south-western extremity of the Baltic is Kiel.

Proceeding towards the north again along the shores of the Baltic, we arrive at Copenhagen, the capital and seaport of Denmark, a large city that has a population which now exceeds half a million. Rather less than ten degrees to the north of this again is Stockholm, the capital of Sweden, and the principal commercial port of that kingdom.

Although there are various ports along the shore of the Gulf of Bothnia to the north of this, none of them is of first-class importance, and in order to arrive at the more notable centres it is necessary to proceed to the west across Sweden and Norway, and to coast southwards until we emerge from the Arctic seas into the Atlantic.

Coming down from the north, the first Norwegian town of note is Trondhjem. We are now in the land of the fjords, and the favourable anchorages are almost as innumerable as the inlets. Very few populous centres, however, exist in these picturesque neighbourhoods, which are now much frequented by tourists.

Bergen, however, a most picturesque fishing-port, has a population of over ninety thousand.

The last town of note on the western coast of Norway is Stavanger, which is usually the first place of call for steamers proceeding from Great Britain to Norway. Christiania, the capital and chief port of the kingdom, is situated in the south at the extremity of the Skager Rack inlet. It is less picturesquely placed than the ports to the west and north. On the other hand, it is an important commercial place, with a population

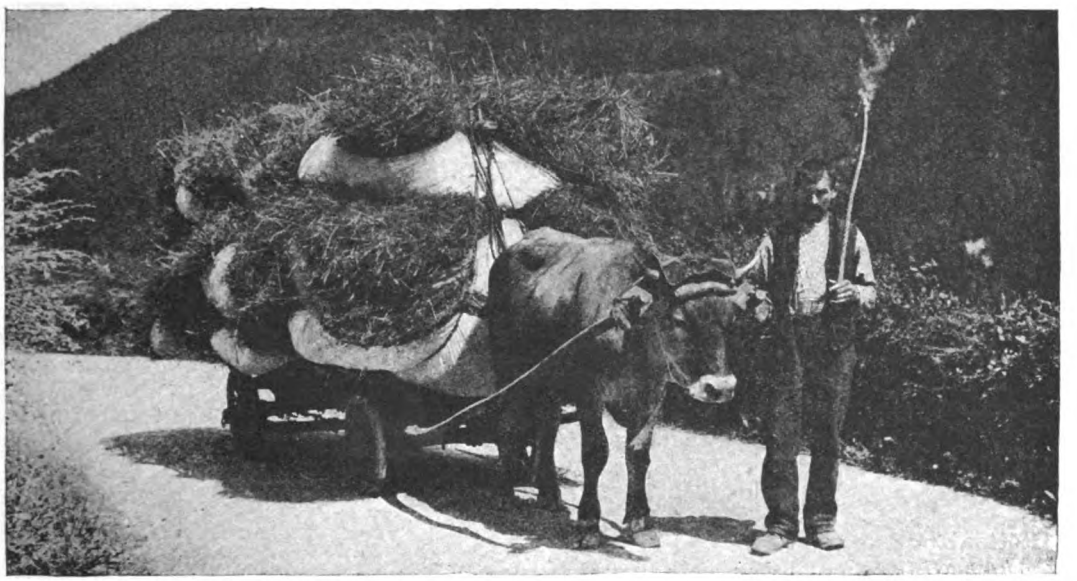


Photo: D. McLeish.

AN OX-DRAWN WAGON IN THE ENGADINE.

The ox cart is also still largely employed in the Iberian Peninsula, the South of France, Italy, and South-Eastern Europe generally.

of over a quarter of a million, and is very largely concerned with the timber trade.

Proceeding southwards, we arrive at the Danish port of Esbjerg, and then at the German ports on the North Sea. The most important of these is Hamburg. This town, indeed, has held the position of the leading commercial city of the mainland of Europe. The lesser city of Altona joins it on the west. As a shipping centre Hamburg can claim to be one of the most notable in the world, and its importance has only been surpassed by the great shipping cities of Great Britain.

North Sea Ports

Another of the chief German shipping centres is Bremen, to the west of Hamburg, situated on the River Weser. Much ship-building is carried on here. The ocean port of Bremen is Bremerhaven.

Following the coast to the south-west we arrive at Dutch territory, and at the large port of Amsterdam, which is approached from the North Sea by way of the North Sea Canal. The entire city, which is built on piles, is intersected by a network of canals. In addition to its other industries Amsterdam is the greatest centre of diamond cutting in the world, and it is here that the finest specimens of rough diamonds come from their various fields to be operated on.

Rotterdam, in conjunction with the Hook of Holland, represents the chief port of Holland. A little to the north-west of this is The Hague, the capital of the kingdom. This town is connected by tramway with Scheveningen, which is at the same time a fishing-centre and a pleasure resort. The southernmost Dutch harbour is Flushing, which is familiar to the majority of travellers as the continental terminus of one of the main sea routes between Great Britain and the continent.

Ostend, to the south-west of this, in Belgian territory, occupies a similar position, while Antwerp, situated on the Scheldt, represents the ocean-going port of the kingdom.

Proceeding to the south-west, the first five French ports to be met with are, in the order named, Calais, Boulogne, Dieppe, Havre and Cherbourg. Every one of these is a terminus of the respective cross-channel routes between England and France. In addition to this, both Havre and Cherbourg are largely concerned with the North and South American trade. The important commercial town of Rouen, too, should claim a place among these northern ports, for, although it lies seventy miles up the River Seine, the stream is navigable as far as that city.

Brest, which lies on the south of the rocky and dangerous point of Ushant, is one of the most important of the French naval stations. It is situated at the northern extremity of the Bay of Biscay. In this bay the two chief ports are St. Nazaire and Bordeaux, the latter town being the famous centre of the French claret industry.

The rocky northern coast of Spain has some good harbours in Santander and Corunna, and in Vigo, a little to the south of Cape Finisterre on the north-west coast, Spain possesses a magnificent anchorage in one of the most beautiful bays of the entire coast. Vigo is the principal port of embarkation for the very numerous Spanish emigrants who are now accustomed to take ship for South America.

Sunny Spain

A few hours' steam to the south of Vigo is Oporto, the northernmost Portuguese sea town of importance. Oporto itself lies a few miles up the Douro River, the bar of which occasionally offers difficulties to navigation. The port of Leixoes has been established just to the north of the mouth of the Douro as the harbour for the largest type of vessels. The harbour is artificial, and its breakwaters have frequently suffered from the force of the heavy Atlantic rollers.

To the south of Oporto again lies Lisbon, the capital and chief port of Portugal. Lisbon is situated half a dozen miles from the mouth of the Tagus, which is very broad here. The harbour of Lisbon is, in consequence, a very fine one, the sole disadvantages being the swift current of the Tagus, and the occasional very rough seas which break upon the bar. But these circumstances, of course, only affect the smaller type of craft. Lisbon itself is a handsome, picturesquely situated town, rising on seven hills from the banks of the Tagus.

On the west of the southernmost point of Spain is Cadiz, which deals with the products of the sunny south of Europe, such as fruits of all kinds, wines and olive oil. The next notable port is Gibraltar, commanding the narrow straits that separate Europe from Africa. After this point we arrive at the Spanish sea towns on the Mediterranean coast. Among the principal of these are Valencia and Alicante, both of which deal in similar produce to Cadiz.

But by far the most important town on

Photo: D. McLeish.

VENICE: GONDOLAS PASSING UNDER THE BRIDGE OF SIGHS

which connects the Palace of the Doge with the State prisons. It was over this bridge that prisoners had to go from the judgment hall to execution. Hence its name.

this coast is Barcelona, situated between the vinegar-producing centre of Tarragona and the French frontier. Barcelona is the principal industrial town as well as the greatest commercial port of Spain. Its chief manufactures are textile goods and firearms.

Continuing the journey to the east, the French coast bordering upon Spain is here heavily indented by the Gulf of Lions, an inlet which is occasionally subject to tempests of a kind from which the Mediterranean is popularly supposed to be immune.

Mediterranean Harbours

On the east coast of the Gulf of Lions is the great French port of Marseilles. This is the principal centre of all French shipping, and from here the liners start for all the eastern ports and for the various South American destinations. Marseilles is also notable for its shipbuilding industry. Historically, the port is one of the most ancient in the western Mediterranean.

Toulon, to the east of Marseilles, is the French Mediterranean arsenal, while a little to the east of this again is Nice, one of a nest of charmingly surrounded pleasure resorts which fringe the Côte d'Azur, by which name this part of the Mediterranean coast is known in France.

Just as the Gulf of Lions announced the French coast to one approaching from the west, so the Gulf of Genoa heralds the Italian soil. The first town of importance here is Genoa, a rich spot owning a fine harbour, and one of the chief centres of the rapidly increasing mercantile marine of Italy. The principal exports from here are fruits and silks.

Proceeding southwards past Leghorn, we arrive at the city of Naples, situated on the shore of its beautiful and famous bay. It is for its picturesque aspects, of course, that Naples is best known, but its commercial side is by no means without importance, and it exports large quantities of fruits, wine, olive oil and silk.

Following the leg of Italy down to its toe, the Straits of Messina separate the mainland from Sicily, the towns of Reggio and Messina facing each other across these classical waters. Beyond Messina, the island of Sicily possesses the ports of Syracuse and Catania, and the town of Palermo on the north coast, which has of recent years become popular as a resort of tourists.

Having rounded the toe of Italy, we may now proceed to the north as far as the port of Brindisi, which has for a long time served as a place of call for the Peninsular and Oriental liners on their way to the East. To the north of Brindisi there are few coastal towns of importance with the exception of Ancona, until, at the northern extremity of the Adriatic, Venice is reached. The romantic aspects of the city of canals and gondolas are too well known to need any description here.

It may be mentioned, however, that in conformity with the spirit of the age, the tendency in modern Venice is for the gondolas to grow less and for the motor launches to increase in number—an arrangement that is very convenient for practical purposes, but which does not add to the picturesque associations for which Venice is so widely famed.

A little to the east of Venice, and formerly within the Austrian frontier, is the port of Trieste, an important shipbuilding centre.

Constantinople

The picturesque little port of Cattaro serves the small kingdom of Montenegro, now joined with Serbia to form the state of Yugo-Slavia. In the Balkan states generally there are few ports of note, the Piræus, the port of Athens, being the most important. Not until we arrive in Turkey is a coastal city of the first magnitude to be met with, and this we find in Constantinople.

Constantinople on the Golden Horn is one of the most beautifully situated cities in all Europe, and as a link between the commerce of the East and of the West it occupies a situation of great strategic advantage. The capital of Turkey has a very cosmopolitan population, and like many purely eastern towns, has its European and Asiatic quarters.

The sole European ports that now remain to be dealt with are those of the Black Sea. On the western coast of this are a certain number of Balkan ports, none of them of any particular note, the chief centres of the inland sea being the Russian towns of Odessa and Batum.

Odessa is of the greatest importance as providing the port of outlet for the pastoral and agricultural products of the enormous area of southern Russia. It is thus the principal wheat-exporting town in Europe, and beyond this it ships large quantities of hides and tallow, as well as some wool.

Batum, which is situated on the eastern extremity of the Black Sea, is chiefly remarkable for being the port of the great Baku petroleum oil-fields, with which district it is connected by railway. W. H. K.

Continued from page 54.

MATHEMATICS:

Contributor: — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.

(M. A. Lewenz, M.A.[Lond.]).

MECHANICS.—XVII

106. **A Machine** in the mechanical sense is a contrivance by means of which a force applied at one point is made to exert force at another point, which differs in direction and intensity from the original force.

The original force applied is called the **effort** and we shall indicate it by P. It is used to overcome at another point some **resistance** or **weight** which we shall indicate by W.

As a matter of fact P is partly used in overcoming internal resistances in the body to which it is applied and also friction, but these we shall ignore as it would complicate our work too much to take them into account.

In every case the machine must be capable of moving the point of application of the resistance;

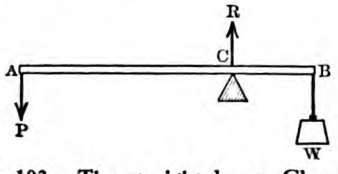


Fig. 103.—The straight lever, Class I.

i.e. it does **work,** and the principle of work tells us that we must put as much work into the machine as we want to get out of it.

The **mechanical advantage** of a machine is the ratio of the resistance to the effort; i.e. mechanical advantage $= \frac{W}{P}$ or $\frac{Q}{P}$.

The uses of simple machines are as follows:

(1) To enable a person to lift weights or overcome resistances greater than he could deal with unaided; e.g. a system of pulleys, wheel and axle, etc.

(2) To cause motion imparted at one point to be transformed into more rapid motion at another; e.g. a bicycle.

(3) To apply a force at a more convenient point; e.g. a poker with which to stir the fire.

The Lever consists essentially of a rigid bar, straight or bent, which has one point fixed about which the whole lever can turn. The fixed point is called the **Fulcrum.**

When the lever is straight we have three classes.

CLASS I. A B is the lever, C the fulcrum, P the effort, W the weight, R the reaction at C. Here P and W act on opposite sides of C.

CLASS II. Here P and W act on the same side of C but P acts at a greater distance from C than W.

CLASS III. Here P and W also act on the same side of C, but P acts at a smaller distance from C than W.

In all these cases we have 3 parallel forces acting

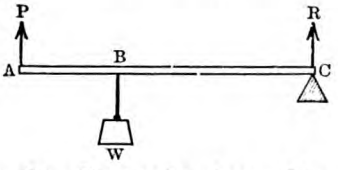


Fig. 104.—The straight lever, Class II.

on the lever, so that for equilibrium the reaction R must equal the resultant of P and W which resultant must act through C.

Hence:

Class I $R = P + W$

Class II $R = W - P$

Class III $R = P - W$

In all three classes, taking moments about C,

$P \times AC = W \times BC \therefore \frac{W}{P} = \frac{AC}{BC}$

i.e. mechanical advantage $= \frac{\text{arm of effort}}{\text{arm of resistance}}$

Clearly in Classes I and II we have a mechanical advantage, and the greater the arm of the effort is in proportion to the arm of the resistance, the greater the mechanical advantage will be.

In Class III we have a mechanical disadvantage,

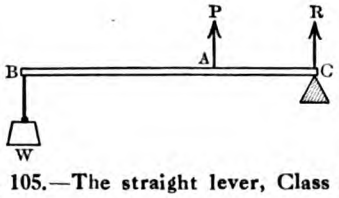


Fig. 105.—The straight lever, Class III.

and its only use is to apply a force at some point where it would be inconvenient to apply the force directly.

The student will note that we have disregarded the weight of the lever itself.

107. Examples of levers.

CLASS I. The handle of a pump; a crowbar

(the fulcrum being the block in front of the weight on which the crowbar rests); a poker (the fulcrum being the bars of the grate).

Double levers of this class are: a pair of scissors or a pair of pincers.

Here the arms of the lever are not straight, but the principle will be clear from the illustration.

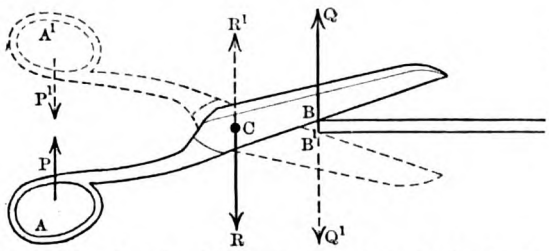


Fig. 106.—A pair of scissors: an example of a double lever.

CLASS II. A crowbar, with one end acting on the ground; a wheelbarrow (the point where the wheel touches the ground being the fulcrum).

Double levers of this class are nut crackers.

CLASS III. The treadle of a turning lathe; the human forearm (the elbow being the fulcrum).

Double levers of this class are a pair of tongs.

108. **The Wheel and Axle** may be said to consist of a cylinder or axle, terminating in two pivots A and B which can turn freely on two fixed supports. A wheel C D is rigidly attached to the axle, and the plane of the wheel is perpendicular to the axle.

Round the axle a rope is coiled, one end of which is firmly attached to the axle, while to the other end

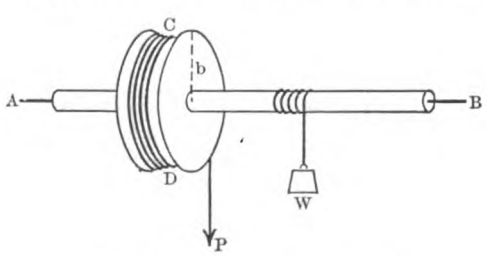


Fig. 107.—The wheel and axle.

is attached the weight W. Round the wheel another rope is coiled in the opposite sense to that on the axle. One end of this is rigidly fixed to the wheel, at the other end the **effort** is applied. The wheel is grooved so that the rope does not slip off.

Mechanical advantage. The condition of equilibrium is the same as if the ropes were perpendicular to the common axis, and consequently the moments of P and W about the axis are equal and opposite. If a be the radius of the axle and b the radius of the wheel, then $P \times b = W \times a$.

Hence the mechanical advantage $= \frac{W}{P} = \frac{b}{a}$.

We may verify this by the **principle of work.** Let the machine turn through 4 right angles.

The amount of rope unwound from the wheel $= 2\pi b$, i.e. P descends a distance $2\pi b$. The amount of rope wound up on the axle $= 2\pi a$, i.e. W is raised a distance $2\pi a$.

By the principle of work $P \times 2\pi b = W \times 2\pi a$

$$\therefore \frac{W}{P} = \frac{b}{a}.$$

Other forms of the wheel and axle are (1) the windlass, in which the power is applied by turning a handle B C at the end of an arm A B.

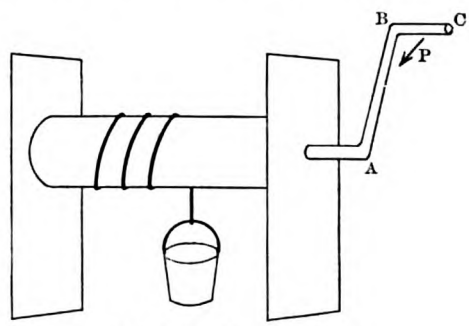


Fig. 108.—The windlass.

The mechanical advantage, if a be the radius of the axle and b be the length of the arm A B, is

$$\frac{P}{W} = \frac{b}{a}.$$

(2) The capstan used on board ship. In this the axle is vertical. The resistance consists of the tension T of the rope round the axle, and the effort is applied at the ends of bars inserted in sockets at the top of the axle.

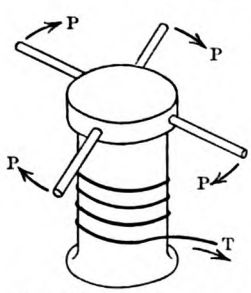


Fig. 109.—The capstan.

109. Examples:—

(1) Where must the fulcrum be so that a weight of 6 lb. may balance a weight of 8 lb. on a straight weightless lever 7 feet long?

Let x feet be the distance of the fulcrum from the 6 lb. weight.

Let y feet be the distance of the fulcrum from the 8 lb. weight.

$6x = 8y$ (i) $\quad x + y = 7$ (ii)

$\therefore 6x = 8(7 - x)$ $\therefore x = 4$ feet and $y = 3$ feet.

(2) With a wheel and axle, an effort of 3 lb. sustains a weight of 48 lb. and the radius of the wheel is 2 ft. Find the radius of the axle.

$$\frac{W}{P} = \frac{b}{a} \therefore a = \frac{b \cdot P}{W} = \frac{2 \times 3}{48} \text{ ft.} = 1\tfrac{1}{2} \text{ inch.}$$

(3) A capstan turned by 12 men is used to haul up an anchor; the levers at the ends of which the men push are 10 ft. long and the radius of the axle is 18 inches. When each man pushes with a force of 1 cwt. they can just raise the anchor. Find the weight of the anchor.

Let x be the weight of the anchor in cwt.

$$P \times b = x \times a \therefore x = \frac{P \times b}{a} = \frac{12 \times 1 \times 10}{\frac{3}{2}}$$

= 80 cwt. = 4 ton.

110. **The Pulley** consists of a wheel grooved along its circumference to hold a string or rope; it can turn freely about an axle at its centre, perpendicular to its plane; the ends of an axle are supported by a frame called the block, and the pulley is said to be movable or fixed according as the block is movable or fixed.

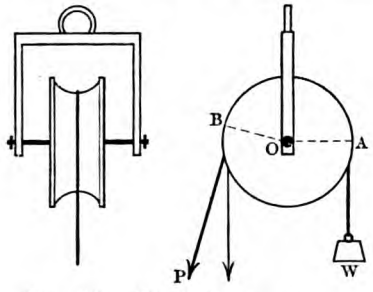


Fig. 110.—Single fixed pulley.

In considering pulleys we shall neglect the weight of the pulley and of the string, both very small as a rule when compared with the weight lifted. Also we shall consider the pulley to be perfectly smooth and hence revolve without friction.

In the **single fixed pulley** the weight is attached to one end of the string passing round the groove and the effort is applied at the other end. It is useful in applying an effort in a different direction from that in which it is convenient to apply it.

The wheel is supported only about the axle, hence the moments of P and W about the centre O are equal;

i.e. P × OB = W × OA ∴ P = W since OA = OB.

The mechanical advantage of the fixed pulley is clearly 1.

In the **single movable pulley** the weight is attached to the block and the effort is applied to one end of the string which passes round the pulley, the other end being fixed.

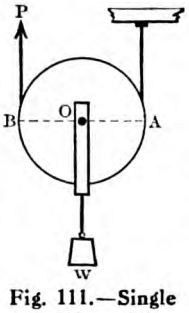


Fig. 111.—Single movable pulley.

If the strings are parallel, then the tensions in each part of the string = P. Also the tensions at A and B both together support W.

i.e. $2T = W \therefore 2P = W \therefore \frac{W}{P} = 2.$

i.e. the mechanical advantage is 2.

111. **Systems of Pulleys.**

First System. Each string is attached to the beam.

To find the relation between the effort and the weight.

The weight is attached to the lowest pulley; the string passing round it has one end attached to a fixed beam and the other to the next highest pulley; the string round the latter has also one end attached to the fixed beam and the other to the next highest pulley; and so on. The effort is applied to the free end of the last string; often this passes over an additional fixed pulley so that the effort may be applied downwards.

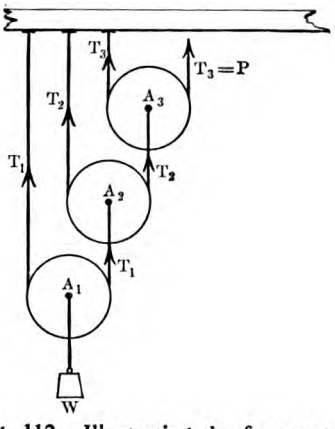


Fig. 112.—Illustrating the first system of pulleys.

Let A_1, A_2, A_3 . . . be the pulleys, beginning with the lowest, and T_1, T_2, T_3 . . . the tensions in the strings passing round them.

If the weights of the pulleys be neglected, since there is equilibrium

$2T_1 = W \therefore T_1 = \frac{1}{2} W$

$2T_2 = T_1 \therefore T_2 = \frac{1}{2} T_1 = \frac{1}{4} W$

$2T_3 = T_2 \therefore T_3 = \frac{1}{2} T_2 = \frac{1}{8} W$

. . . . . .

Hence in our figure $P = \frac{1}{8} W$ or the mechanical advantage = 8

If n be the number of pulleys $\frac{W}{P} = 2^n$

Verification by the Principle of Work.

If W be raised through a distance x, the pulley A_2 would, if the distance $A_1 A_2$ remained unchanged, also rise through a distance x. But the length of the string joining A_1 to the beam is shortened by x, and this length x of the string slips round A_1 and consequently A_2 rises $2x$. Similarly A_3 rises $2 \times 2x = 4x$.

Since A_3 rises $4x$ the parts of the string joining it to the beam and the point at which P is applied, both are shortened by $4x$. The slack part of the string runs round the pulley A_3 and hence the point of application of P rises $4x + 4x = 8x$.

Thus by the principle of work

$W \times x = P \times 8x$

$\therefore$ the mechanical advantage $= \frac{W}{P} = 8$

As more pulleys are used the mechanical advantage is increased.

112. **Second System.** The same string passes round all the pulleys.

To find the relation between the effort and the weight.

In this there are two blocks, each with pulleys. The upper block is fixed and the lower movable.

If the number of pulleys in the blocks be the same, the string must be attached to the upper block.

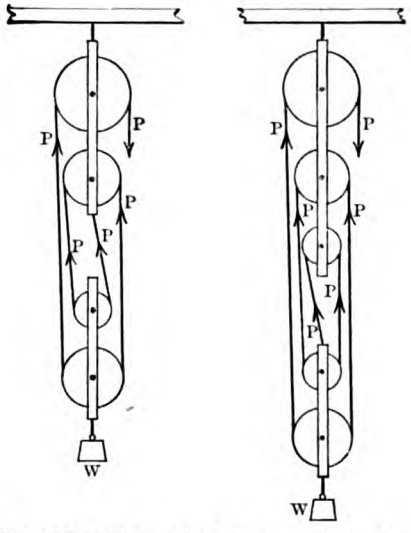


Fig. 113.—Illustrating the second system of pulleys.

If there be one more pulley in the upper block than in the lower, the string must be attached to the lower.

In Fig. (i) the number of portions of string connecting the blocks is even; in Fig. (ii) it is odd.

Since there is only one string the tension throughout is the same and equal to P.

Let n be the number of parts of string supporting the lower block with the weight W.

The n upward forces P support the downward force W.

Hence $W = nP$ and the mechanical advantage $= \frac{W}{P} = n$.

113. **Third System.** All the strings attached to the weight.

To find the relation between the effort and the weight.

In this system one end of the string passing round any pulley is attached to the bar with the weight, and the other end is attached to the next lower pulley. The power is applied to the free end over the lowest pulley. The top pulley B is fixed, the pulleys A_1, A_2, A_3 are movable.

Let the tensions in the strings be T_1, T_2, T_3, T_4 respectively.

Then $T_1 = P$.

Considering the equilibrium of the pulleys taken in order and beginning with the lowest, we have:

$T_2 = 2T_1 = 2P$
$T_3 = 2T_2 = 4P$
$T_4 = 2T_3 = 8P$

Now the bar from which W is suspended is in equilibrium, hence $W = T_1 + T_2 + T_3 + T_4$
$= P + 2P + 4P + 8P$
$= 15P$

$\therefore$ mechanical advantage $= \frac{W}{P} = 15$.

If n be the number of pulleys, summing the geometrical progression, we should find $\frac{W}{P} = 2^n - 1$*.

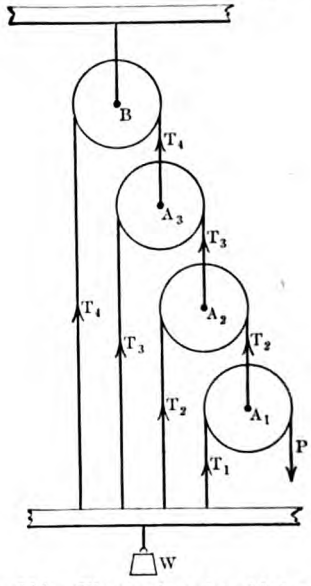


Fig. 114.—Illustrating the third system of pulleys.

Key to Exercise 17

(1) 2 lb.; 1·732 lb. (2) A point $4\frac{2}{3}$ cm. from the side connecting the masses of 1 gm. and 10 gms. and $2\frac{1}{2}$ cm. from the side connecting the masses of 1 gm. and 2 gms.

(3) Weight must not exceed 1 cwt. (4) $1\frac{1}{4}$ ft.

(5) 2 oz.; 12 in. (6) (*a*) $\frac{1}{3}\sqrt{3}$ cwt. wt. (*b*) 56 lb. wt.

M. A. L.

CO-ORDINATE GEOMETRY.—III

The Straight Line (*continued*)

20. *To find the equation of a straight line passing through a given point and making a given angle with the axis of* X.

Let x' y' be the given point and tan $-$ $1m$ the given angle.

The equation of a line making the angle tan $-$ $1m$ with the axis of X is

$$y = mx + c \quad \text{(i)}$$

but x' y' is a point on the line

$$\therefore\ y' = mx' + c \quad \text{(ii)}$$

hence by subtraction

$$y - y' = m\,(x - x') \quad \text{(iii)}$$

* The student should verify the 2nd and 3rd systems of pulleys by the Principle of Work.

Now supposing we know that a line passes through a given point $x'\ y'$, the equation (iii) may be made to represent any such line by giving a suitable value to m. Hence if besides passing through $x'\ y'$ the line has to satisfy another condition, we can determine the value of m from this condition and then (iii) will represent the required line.

21. *To find the equation of a straight line passing through two given points.*

Let $x'\ y'$ and $x''\ y''$ be the two given points.

Take the general form

$$y = mx + c \qquad \text{(i)}$$

since $x'\ y'$ is on the line

$$y' = mx' + c \qquad \text{(ii)}$$

since $x''\ y''$ is on the line

$$y'' = mx'' + c \qquad \text{(iii)}$$

From (i) and (ii) by subtraction

$$y - y' = m\ (x - x') \qquad \text{(iv)}$$

From (iii) and (ii) by subtraction

$$y'' - y' = m\ (x'' - x') \qquad \text{(v)}$$

Hence from (iv) and (v)

$$\frac{y - y'}{y'' - y'} = \frac{x - x'}{x'' - x'},$$

which is the equation of the required line.

Corollary.—The equation of the straight line joining the point $x'\ y'$ to the origin is $xy' = x'y$.

22. *To find the co-ordinates of the points of intersection of two given straight lines.*

Let the equations of the two straight lines be

$$Ax + By + C = 0 \qquad \text{(i)}$$
$$A'x + B'y + C' = 0 \qquad \text{(ii)}$$

Then the co-ordinates of a point $x'y'$ which is common to both lines must satisfy both (i) and (ii), hence

$$\frac{x'}{BC' - B'C} = \frac{y'}{CA' - C'A} = \frac{1}{AB' - A'B}$$

which determines x' and y'

23. *To find the condition that three straight lines may meet in a point.*

Let the equations of the three straight lines be

$$Ax + By + C = 0 \qquad \text{(i)}$$
$$A'x + B'y + C' = 0 \qquad \text{(ii)}$$
$$A''x + B''y + C'' = 0 \qquad \text{(iii)}.$$

If (i), (ii) and (iii) meet in a point, the point of intersection $(x'y')$ of (i) and (ii) must lie on (iii).

Now x' and y' are given by

$$\frac{x'}{BC' - C'B} = \frac{y'}{CA' - C'A} = \frac{1}{AB' - A'B}$$

The condition that the point $x'y'$ may be on (iii) is

$$A''\frac{BC' - B'C}{AB' - A'B} + B''\frac{CA' - C'A}{AB' - A'B} + C'' = 0,$$

or $A''(BC' - B'C) + B''(CA' - C'A) + C''(AB' - A'B) = 0$

24. *To find the condition that three points shall lie on a straight line.*

Let the points be $x'y'$, $x''y''$ and $x'''y'''$

Now in § 21 we found that the equation of the straight line joining $x'y'$ and $x''y''$ is

$$\frac{y - y'}{y'' - y'} = \frac{x - x'}{x'' - x'} \qquad \text{(i)}.$$

For the condition to be satisfied the point $x'''\ y'''$ must lie on (i).

Hence the condition is

$$\frac{y''' - y'}{y'' - y'} = \frac{x''' - x'}{x'' - x'},$$

or $y'(x'' - x''') + y''(x''' - x') + y'''(x' - x'') = 0.$

25. *To find the angle between two straight lines whose equations are given.*

(1) If the equations of the lines are given in the form

$$y = mx + c$$
$$y = m'x + c'$$

then *if* $\alpha + \alpha'$ be the angles which these lines make with the axis of x, $\tan \alpha = m$ and $\tan \alpha' = m'$ and $\tan (\alpha' - \alpha) = \frac{m' - m}{1 + mm'}$; hence the required angle is $\tan^{-1} \frac{m' - m}{1 + mm'}$.

The lines are parallel if $m = m'$ and perpendicular if $1 + mm' = 0$.

(2) If the equations of the lines be given in the form

$$x \cos \alpha + y \sin \alpha = p$$
$$x \cos \alpha' + y \sin \alpha' = p'.$$

Since the angle between the lines is the same as the angle between the perpendiculars from the origin upon them, the required angle is $\alpha - \alpha'$ or $\pi - (\alpha - \alpha')$

(3) If the equations of the line be given in the form

$$Ax + By + C = 0$$
$$A'x + B'y + C' = 0,$$

we may write these $y = -\frac{A}{B}x - \frac{C}{B}$

and $y = -\frac{A'}{B'}x - \frac{C'}{B'}$,

which correspond with the forms $y = mx + c$ and $y = m'x + c'$ (see above).

Hence the required angle is $\tan^{-1} \frac{-\frac{A'}{B'} + \frac{A}{B}}{1 + \frac{AA'}{BB'}}$

$$= \tan^{-1} \frac{AB' - A'B}{AA' + BB'}.$$

The lines are parallel when $AB' = A'B$ and are perpendicular to each other when $AA' + BB' = 0$.

Now the condition of perpendicularity is clearly satisfied by the two straight lines

$$Ax + By + C = 0 \text{ and } Bx - Ay + C = 0$$

also by

$$Ax + By + C = 0 \text{ and } \frac{x}{A} - \frac{y}{B} + C' = 0.$$

Hence if in the equation of a given straight line we interchange or invert the coefficients of x and y, and change the sign of one of them, we have the equation of a straight line perpendicular to the first, and if this perpendicular has to satisfy another condition we can assign any suitable value to the constant C'.

26. *To find the equation of a straight line passing through a given point and parallel to a given straight line.*

Let $x'\ y'$ be the given point.

Let $y = mx + c$ be the equation of any line

parallel to the given straight line, then the value of the constant m is known.

Since $x'\ y'$ is a point on the line, we have

$y' = mx' + c \therefore c = y' - mx'$

hence the required equation is $y = mx + (y' - mx')$,

or $y - y' = m(x - x')$.

27. *To find the equation of a straight line passing through a given point and perpendicular to a given straight line.*

Let $x'\ y'$ be the given point.

Let $y = mx + b$ be the given straight line.

Since $y - y' = m'(x - x')$ represents any straight line through the point $x'y'$ (see § 20), and the condition that this line should be perpendicular to $y = mx + b$ is $1 + mm' = 0$ or $m' = -\frac{1}{m}$ (see § 25) (1), the required equation is

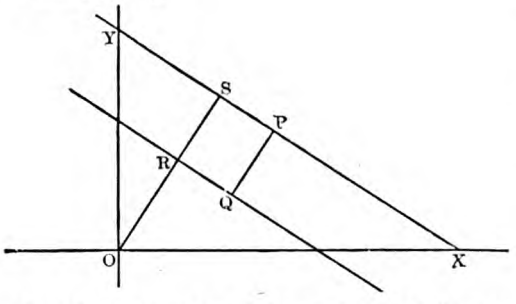
$$y - y' = -\frac{1}{m}(x - x') \text{ or } y - y' = \frac{1}{m}(x' - x).$$

If the given straight line is represented by the equation $Ax + By + C = 0$, the required equation will clearly be $A(y - y') = B(x - x')$.

28. *To find the length of the perpendicular from a given point on a given straight line.*

Let the equation of the given straight line be $x \cos \alpha + y \sin \alpha = p$ (i)

Then $OR = p$



Let the co-ordinates of the given point P be $x'y'$.

Through the given point P draw a straight line parallel to the given straight line.

Its equation will be $x \cos \alpha + y \sin \alpha = p'$ (ii) where $OS = p'$.

But since this line passes through the point P

$x' \cos \alpha + y' \sin \alpha = p'$ (iii)

Now if PQ be the perpendicular from P on the given straight line

$PQ = SR = OS - OR = p' - p = x' \cos \alpha + y' \sin \alpha - p$.

Thus the length of the perpendicular $= x' \cos \alpha + y' \sin \alpha - p$.

This expression is positive as long as p' is positive and greater than p. If, however, p' is less than P, i.e. if the given straight line does not lie between the given point and the origin, the expression becomes negative, and we have as a full solution, length of perpendicular $= \pm (x \cos \alpha + y \sin \alpha - p)$.

If the equation of the line be given in the form $Ax + By + C = 0$, the length of the perpendicular from any point on the line will be

$$\frac{Ax' + By' + C}{\sqrt{A^2 + B^2}} \text{ (see § 18).}$$

From this it is clear that the condition that a particular point $x'y'$ shall lie on a given straight line is $Ax' + By' + C = 0$, is equivalent to saying that the length of the perpendicular from the point on to the line must be zero.

29. *To find the equation of a straight line bisecting the angle between two given straight lines.*

Let the equations of the two straight lines be

$x \cos \alpha + y \sin \alpha - p = 0$ (i)

and $x \cos \beta + y \sin \beta - p' = 0$ (ii).

Now the perpendiculars from any point on the bisectors of the angle contained by (i) and (ii) on to the lines (i) and (ii) are equal.

Hence if $x'y'$ be a point on either bisector we have $(x' \cos \alpha + y' \sin \alpha - p) = (x' \cos \beta + y' \sin \beta - p')$ since this expresses the fact that the perpendiculars are equal in length.

Hence the point $x'y'$ lies on one or other of the lines $x \cos \alpha + y \sin \alpha - p = \pm (x \cos \beta + y \sin \beta - p')$ (iii) and (iii) gives us the required bisectors.

If the lines were expressed in the forms

$Ax + By + C = 0$ and $A'x + B'y + C' = 0$

we should get for the equations of the bisectors

$$\frac{Ax + By + C}{\sqrt{A^2 + B^2}} = \pm \frac{A'x + B'y + C'}{\sqrt{A'^2 + B'^2}}.$$

30. *To find the equation of a straight line through the point of intersection of two given straight lines.*

The student would probably find the co-ordinates $x'y'$ of the point of intersection, and then use the form $y - y' = m(x - x')$ for the equation of any straight line passing through it, but the following method is often preferable. Let the equations of the two straight lines be $Ax + By + C = 0$ (i) $A'x + B'y + C' = 0$ (ii)

Then it is clear that any point whose co-ordinates satisfy the equations (i) and (ii) will also lie on the line

$Ax + By + C + K(A'x + B'y + C) = 0$ (iii)

Where K is any constant, for if the co-ordinates satisfy (i) and (ii) they must also satisfy (iii).

31. If the equations of three straight lines be $Ax + By + C = 0$ (i), $A'x + B'y + C' = 0$ (ii), $A''x + B''y + C'' = 0$ (iii), and if we can find three constants l, m, n such that the equation $l(Ax + By + C) + m(A'x + B'y + C') + n(A''x + B''y + C'') = 0$ (iv) is identically true, the three straight lines will meet in a point; for any point which lies on any two of the lines, i.e. whose co-ordinates satisfy any two of the equations (i), (ii) and (iii), must lie on the third line as well, since by (iv) its co-ordinates must satisfy the third equation.

Exercise 6

(1) Write the following equation in the form $x \cos \alpha + y \sin \alpha + p = 0$: $3x + 4y - 15 = 0$.

(2) Find the equations of the perpendiculars at the middle points of the triangle (2, 1), (3, — 2), (— 4, — 1). At what point do they intersect?

(3) Find the length of the perpendicular from the origin on the line $3x + 4y + 20 = 0$.

(4) On which sides of the line $y - 2x + 1 = 0$ are the points 0, 0 and (3, 4)?

(5) Find the angle between the lines $x + 2y - 4 = 0 + 2x - y + 1 = 0$. M. A. L.

Continued from Vol. V., page 494.

ART AND MUSIC:

Contributors **:—THE THEORY OF ART (Hon. John Collier; J. G. B. Lynch). DRAWING AND PAINTING (J. G. B. Lynch). THE THEORY OF MUSIC (R. R. Terry, Mus.Doc., F.R.C.O.; Hubert Grant).**

SKETCHING FROM NATURE.—II

You will find that it follows quite naturally, when you have grown used to draw simple out-of-door things really well, that you can then safely turn your attention to something more elaborate. And almost immediately you turn from quite the simplest objects you find yourself having to invoke the aid of Perspective. The difficulty of drawing retiring lines from Nature can best be appreciated by those who have already devoted searching inquiry into perspective as regards the flat.

Retiring Lines and—

It is difficult there and, of course, where you have an unbounded object, so to speak, before you and not merely another man's drawing reproduced on a page, the difficulties are tenfold. *But only for those who have neglected the study from the beginning.* If you have thoroughly and conscientiously learnt the subject as it was described in the earlier pages of the New Popular Educator, then the difficulties though still considerable will be to some sensible degree mitigated.

Objects like the posts you have seen in the sketch on p. 489, Vol. V., have no retiring lines, because they are parallel with the picture plane and with your station point. Their lines are horizontal and perpendicular. In the former case you draw these lines across the picture from left to right, in the latter case you draw them up and down. That is perfectly simple. There is no real difficulty with objects of that kind. It is simply a question of exercising and practice to get this type of drawing perfect. However, when you come to the drawing of lines which have different directions with regard to the picture plane or with your position, lines which retire and go away from you, you have to abide by certain strict rules unless you wish to be tied up in a maze of troubles and difficulties.

The best instance of retiring lines is to be observed from a railway bridge over a straight piece of track. The lines are wide apart immediately beneath you near the bridge. But the farther they go away on either side, the closer they seem to converge. This instance may be complicated. The railway track may be straight, but it may go up or down a hill.

These alternatives, of course, make a considerable difference in the drawing of them. For this sort of drawing then, whether the object be composed of simple and mathematical lines, as in a railway, or the more complicated lines of a retiring road or river, a sound knowledge of geometrical perspective is necessary.

—Retiring Planes

This you will have learnt already from preceding lessons in drawing. The knowledge will now come in exceedingly useful; indeed without it you would have little hope of success save now and again by a pure chance.

Now study the sketch on p. 116 with a view to choosing a similar subject for yourself. This is simply a narrow little old street, such as you may find almost anywhere. This sketch is entirely composed of lines, straight, and going in various directions; it is also full of retiring lines amongst others. You can scarcely go anywhere without finding an object in all essentials the same as this from your present point of view.

Therefore, all that is said about the sketch here reproduced, will do equally well for the similar object of your own choice. The same rules would apply to the interior of, say, a church or a big hall. It is the question of lines which is important. Before going further you should go back to all that has been said about retiring lines and retiring planes, and refresh your memory and make certain that you have the details of the subject thoroughly in your head.

In regarding Fig. 92 you must suppose that you are sitting opposite the end of the street at a distance of twenty or twenty-five yards from the next building. You have examined your subject

thoroughly before attempting to draw at all. So you will know which lines retire from you and which are parallel. But, this apart, you will also have observed very carefully the general character of the object, the details which are important and the relative position of one part to another.

First of all, after this exercise in observation, you must find your line of sight, or, as we called it in the lessons in drawing, H.L., the horizontal line. If you hold up your pencil horizontally in front of your eye, you will notice (and remember) the places where the pencil cuts through the lines of your object. For instance, it goes across the door on the right-hand side at about two-thirds the way from the step.

Fig. 92.—The student who aspires to sketch from nature must first be able to tackle with confidence subjects, such as that shown above, which he will meet with everywhere.

It is exceedingly important to start in this way, because you must remember that all horizontal retiring lines have their vanishing points on the line of sight. The next step will be in observing whether the H.L. cuts through the middle of the paper. This is so only when half of the subject appears above the horizontally held pencil and half of it below. In this particular case the H.L. comes at about one-third from the bottom of the subject. You must draw the H.L. accordingly on your paper.

The next thing to determine is the Point of Sight, which is invariably directly opposite your eye on the H.L. You should sit so that the sides of the street retire at right angles with your position. Notice the P.S. in Fig. 92. All the lines of the right-hand buildings vanish there: these being the lines of the eaves of the roof, the bottoms and tops of the windows, the tops of the doors, the foundation line, and the courses of the bricks. These are all parallel with each other in actuality and are at right angles with the point at which you sit.

Notice how the lines of the buildings on the left-hand side disappear at the vanishing point (marked V.P.). They do not retire in the same direction, for the two sides of the street do not happen to be strictly parallel.

You should always aim to discover, not the mere *whereabouts* of the P.S., but its *exact* position. This may be done quite easily. In the present instance, hold your pencil so that it precisely follows the lines of the eaves. Then carry your eye along this till it reaches the line of sight. Where the pencil cuts this line will be the exact P.S.

If you wish to prove this, all you have to do is to put the pencil on some other line that runs parallel with the eaves—the tops of the doors, for instance—and you will find the pencil coming to the same point on the line of sight as before. Or, if you hold out your arm horizontally and put it parallel with the retiring lines of the houses, you will find that your finger points to the P.S.

Do not draw any lines until you have very carefully marked in these positions. Begin with that which is next to the P.S. You should always make a practice of doing this; that is to say, begin to draw from the P.S.

Then, as you go on, mark in the position of each line whether to right or left which crosses the line of sight. Always begin at the P.S. Then you have to decide about the height of perpendicular lines which go through these points of position. Always remember that whatever perspective forces an horizontal line to do whether receding or not, all perpendicular lines in reality remain perpendicular in your drawing. There is no exception whatever to this rule.

Bear in mind that all these precautions which you must take as a beginner help you in achieving good work in the future. You must, of course, continue to take care and use the same old precautions even when you become an accomplished artist, but once you have mastered them at the beginning of your career, everything is made easier for you: though, naturally, as is the way of things, the case grows by such imperceptible degrees that you are not aware of its approach, and by the time you can do with great ease those things which gave you sleepless nights as a beginner, you will have ceased to care whether your task is troublesome or not.

J. G. B. L.

Continued from page 60

BUSINESS AND COMMERCE:

***Contributors*:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).**

COMMERCIAL TRAINING.—XXXVI

On examining the financial columns of a newspaper it will be observed that some stocks and shares are marked "ex div.," whilst others are "cum div." To explain these terms, we must point out that companies or corporations close their transfer books for a period of a fortnight or three weeks twice during each financial year when they pay interest or dividends half-yearly; once a year when an annual disbursement is made. The dates between which the transfer books are closed are notified by means of advertisement in the newspapers, and, whilst books are closed, no transfer of stock is made.

Stock Exchange Abbreviations

Now, if a person purchased stock or shares during a period when the transfer books were closed, it is obvious that the securities could not be inscribed in his name until the books opened again; so the question would arise as to who should receive the forthcoming interest or dividend, the buyer or the seller. When shares are marketed therefore round about the time of the annual or half-yearly disbursement of profits they are marked "cum div." or "ex div." the former meaning that the dividend goes to the buyer, and the latter, that the seller is is entitled to retain it.

The latest development and change in official Stock Exchange prices is notified throughout the commercial world by means of the tape machine. This ingenious invention automatically prints the prices recorded by the operator, the printing surface being a narrow tape of paper that is drawn from a large roll, the tape unfolding continuously.

Naturally, the names of the stocks and shares quoted upon the tape are very much abbreviated, Canadian Pacifics becoming Can. Pacs., for instance; but it is not difficult to make oneself conversant with the contractions in general use. During the progress of a boom in stocks and shares the interest in the tape machine increases and brokers watch eagerly the printed ribbon in order to snatch a profit or to cut a loss.

There are a few common terms in use upon the Stock Exchange with which the student of business and commerce should make himself conversant. For example, a "bull" is a person who buys stocks or shares in the expectation of their rising in price in order that he may afterwards sell at a profit. A "bear" is the precise opposite. He sells shares, which, in the majority of cases, are not in his possession at all, because he considers the price will go down. Then he can buy in the shares at a low price to deliver at the price at which he has sold and so reap his profit.

New Issues

So much for the buying and selling of stocks and shares. We come now to the routine of securing stocks or shares in new issues. When a private venture or undertaking is converted into a limited liability company it is of frequent occurrence for the ordinary shares to be retained solely by the former owners, the vendors, as they are termed. In such cases, there would probably be offered to the public only preference shares.

In other cases, when a company is formed both ordinary and preference shares would be offered for public subscription. In still further instances debentures might be issued, or deferred stock; or a government or municipal issue for some express purpose.

Generally speaking, a new issue of capital or the offer of some new securities is heralded by a prospectus, a most important instrument, copies of which must be lodged at Somerset House. This prospectus is obtain-

able from the offices of the particular company concerned, from their bankers and branches, and from certain stockbrokers; and, in a great many cases, an abridged prospectus is printed in the more important of the newspapers.

A person who wishes to avail himself of the offer made in the prospectus should therefore fill up the Application Form, showing precisely the number of shares he is prepared to take, his name and full address, his occupation and his signature as used for banking purposes. With this Application Form, which he forwards to the office of the company as directed, he encloses a cheque to cover a deposit on the amount of shares for which he has applied.

Preferential Treatment

There is always a date given up to which applications for shares will be received; but, in some cases, the lists are closed before this date, in which instance some notification is given in the newspapers. It is well, however, when one has made up one's mind to apply for shares to do so without delay to avoid the risk of the lists being closed in the meanwhile.

Occasionally an applicant may have his form marked by a director in order that he may receive preferential treatment in the allotment; but this is by no means a universal custom. We will assume, then, for the purposes of this lesson, that the date has arrived when the lists are closed and that all the applications are gathered together and thoroughly examined. The result may show that there are more applications for shares than there are shares to be issued; and, in this case, the allotment proceeds at the discretion of the directors, for it is an axiom of good company management to have a large number of comparatively small shareholders rather than a few holders of larger blocks.

In any case, the shares that have been on offer are allotted. Many companies "underwrite" a proportion of their shares as a policy of safety. That is to say, they arrange with an underwriter for a consideration for him to take over a certain bulk of the shares to be issued; and then, if the public applications should fall short of expectations, the underwriter is called upon to accept such part of the shares he has contracted to take as may be necessary.

The allotment of shares is followed by the issue of Letters of Allotment, which convey to the shareholder the precise number of shares that have been allotted to him out of those for which he applied. He may obtain all for which he asked, or only a proportion. When an issue is very much oversubscribed, it frequently happens that "Letters of Regret" are sent out to a certain proportion of the applicants, such letters containing the intimation that no shares can be allotted and enclosing a cheque equivalent to the amount of the deposit originally tendered.

A letter of allotment is followed by a Call. That is to say, the shareholder is called upon to pay a further instalment of the purchase price of the shares that have been allotted to him; and these calls will continue at the intervals stated on the prospectus until such time as he has paid in full for the shares.

When this period has been reached and the last call has been paid the shareholder may then exchange his allotment letter and the receipts for the various calls for a share certificate. In some cases, however, capital is issued on the understanding that at the time it shall remain only partly-paid. In such instances, the certificates would be issued when the amount to be paid for the time had been reached; and the certificates would be issued marked 10s. Paid, or whatever the figure might be.

Shareholders' Meetings

Shareholders in companies receive once a year, and, in some instances, twice yearly, a balance sheet that is a complete summary at a given date of the accounts of the company. On one side is shown precisely the sum total of the capital issued and of all the debts and liabilities of the concern. On the other side appears the assets or possessions of the company, together with statements as to stock, cash, property, buildings, goodwill and so on. The profits for the period under consideration will also be shown.

The receipt of a balance sheet usually heralds a General Meeting of the shareholders of the company; and at this meeting each holder is entitled to vote according to his holding, and to the terms under which the shares were issued as set out in the original prospectus.

On the marriage of a lady shareholder it is necessary that she shall communicate with the secretary of the particular company at its registered offices, enclosing a copy of her marriage certificate. On the death of a shareholder the course is for his or her executors or administrators to produce the probate taken out upon his or her will, and also the death certificate. A. B.

BOOK-KEEPING.—XXXVI

MENTION has already been made of analysed and tabular books, particularly in dealing with petty cash and self-balancing ledgers, so that the student will readily understand what is meant by columnar or tabular book-keeping. It is not a system of book-keeping as distinct from double entry, although variations do occur where tabular books are in use.

Tabular Book-keeping

Where departmental accounts are kept, both sales and purchases books may take the tabular form, and when ledgers are self-balancing the cash book is analysed. We have already noticed an example of a *Tabular Ledger* in the Share Ledger of a Limited Company (*see* Vol. IV., pp. 372-3), whilst Bill books are of the same nature. In order to illustrate this type of book more fully, reference may be made to hotel book-keeping.

The observant hotel visitor may have noticed that each visitor is known by the number of his room, and that everything ordered through the waiter is entered in a book with counterfoils. The book is often arranged in triplicate. One counterfoil is handed in at the office, and from this the *Visitors' Ledger* is posted, one goes to the kitchen and is used in conjunction with the Stock Book, whilst the third remains in the waiter's book.

Hotel Accounts

The *Visitors' Ledger* is unlike the ledger in an ordinary commercial house. Except for the waiter's slip it would be a book of original entry containing visitors' personal accounts, nominal accounts being posted from the Visitors' Ledger, which forms the Sales Ledger.

From this the visitor's "*bill*" is made out, the form of the statement usually following the form of the Ledger. Each column on the statement represents a day, whilst each page in the Ledger represents a day, items charged being entered under the room number. The following ruling will be easily followed.

National Telephone 410. Telegrams—' Westgate, Blankshire."

No. 1.

MR H. R. BROWN.

THE WESTGATE HOTEL,
BLANKSHIRE.

VISITORS ARE REQUESTED TO DEMAND A PRINTED RECEIPT.

May	17th			18th		
	£	*s.*	*d.*	£	*s.*	*d.*
Brought forward ..				1	1	–
Apartments		5	6		5	6
Attendance		1	–		1	–
Baths		1	–		1	–
Fires, Lights						
Breakfast		2	–		2	–
Luncheon					2	6
Dinner		3	–		3	–
Tea and Coffee						
Supper						
Servants' Board						
Wines		4	6		5	–
Spirits, Liqueurs		1	–		1	6
Ales and Stout, etc. ..						
Mineral Waters						
Cigars, etc.						9
Paid out			6			
Washing						
Carriages		2	6			
Billiards					1	–
Sundries						3
Total	£1	1	–	£2	4	6
Carried forward ..	£1	1	–			

VISITORS'

DEBITS.	H. R. Brown Room 1.			T. Smith Room 2.			E. Sykes Room 3.											
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Bal. brought Forward	1	1	–	5	–	–	–	–	–									
Apartments		5	6		10	6		6	–									
Attendance		1	–		2	–												
Baths		1	–															
Fire and Lights ..					2	–												
Boarders																		
Breakfasts		2	–		4	–												
Luncheons		2	6		5	–												
Dinners		3	–					3	–									
Tea and Coffee																		
Soups																		
Suppers					3	6												
Servants' Board ..					5	–												
Spirits and Liqueurs		1	6		2	–												
Wines		5	–		8	4		2	3									
Ales, Stout, etc. ..																		
Minerals						6												
Cigars			9						6									
Newspapers																		
Postage					1	–												
Paid Out																		
Washing					3	–												
Carriage																		
Billiards		1	–															
Sundries			3		1	3												
TOTAL	£2	4	6	£7	8	1		11	9									
CREDITS.																		
Overcharges																		
Cash Received				6	–	–												
Ledger a/c																		
Bal. carried Forward	2	4	6	1	8	1		11	9									
TOTAL	£2	4	6	£7	8	1		11	9									
Folio Ledger—a/c ..																		
Transferred to																		

The term "loose-leaf ledger" is apt to give the student a wrong impression of the nature of this class of ledger, which is daily coming into more common use. The leaves of the ledger are loose only previous to their incorporation in the ledger, and afterwards when the mechanism of the binding is released for the purpose of extracting or adding a page or pages.

A loose-leaf ledger is an ordinary ledger bound in a form which admits of the removal and addition of pages, so that when an account is closed the page which it occupies can be removed, or when a page is full a new continuation page may be added and it is not necessary to give the account a fresh folio number. Closed accounts are removed from the current binder after all entries have been checked, and the used sheets are placed in transfer binders in consecutive order. The result is that only "live" accounts remain in the ledger, consequently current business is more easily handled.

Several objections are raised to "loose-leaf" ledgers, but even the ordinary book ledger is not immune from fraudulent manipulation. Amongst the so-called drawbacks are :—

LEDGER.

£	s.	d.	£	s.	d.	DEBITS.	Daily Total. £	s.	d.	Brought Forward. £	s.	d.	Carried Forward. £	s.	d.
						Balance brought Forward	6	1	–						
						Apartments	1	2	–						
						Attendance		3	–						
						Baths		1	–						
						Fire and Lights		2	–						
						Boarders									
						Breakfasts		6	–						
						Luncheons		7	6						
						Dinners		6	–						
						Tea and Coffee									
						Soups									
						Suppers		3	6						
						Servants' Board		5	–						
						Liqueurs and Spirits ..		3	6						
						Wines		15	7						
						Ales, Stout, etc.									
						Minerals			6						
						Cigars		1	3						
						Newspapers									
						Postage		1	–						
						Paid Out									
						Washing		3	–						
						Carriage									
						Billiards		1	–						
						Sundries		1	6						
						TOTAL	£10	4	4						
						CREDITS.									
						Overcharges									
						Cash received	6	–	–						
						Ledger a/c									
						Balance carried Forward	4	4	4						
						TOTAL	£10	4	4						
						Folio Ledger a/c									
						Transferred to									

1. The ease with which accounts might be withdrawn or destroyed.

2. The ease with which accounts might be substituted.

3. The danger of loss owing to sheets being mislaid.

The first objection, whilst more powerful than the other two, is not of great moment where locked ledgers are used. The second danger is guarded against by having spare sheets properly numbered, stamped with the firm's name, and kept in the care of a trustworthy official. The third danger is not so real in the case of the loose-leaf system as it is in the card ledger system. It is not a fault of the system so much as a possibility of carelessness arising out of an abuse of the system.

In business houses the card index is used in various ways. It usually forms the basis of filing systems, but it is adapted to book-keeping in cases where it is possible to keep ledger accounts on cards, e.g. where payments are made by stated instalments at stated times.

For ledger purposes a particular customer has a given number which appears on his index card. This card is placed in the drawer

in alphabetical or dictionary order. A clerk wishing to find the ledger account of J. Robinson, Limited, of Belfast, looks up the card index and finds that the number assigned to the account is 273. He then turns to the drawer containing ledger cards and finds them numerically arranged in groups of 100, subdivided by guide cards into groups of ten, and sometimes bearing a units tab on the particular card itself. This 273 will be found behind guide card 200, and between sub-guide cards 70 and 80, and it may itself bear a tab marked " 3." Other methods may be adopted, but posting is quicker when the numerical method is in use. The guide cards may be with advantage of various colours, say blue for hundreds and red for tens.

Where instalments are payable and the accounts are numerous, so-called " tickler " cards are used, and these are so arranged that they come up on the particular day on which the next instalment falls due. The system is capable of expansion, special methods being applied to overdue accounts. Closed accounts are transferred to other drawers in consecutive order, just as leaves of the loose-leaf ledger are put in transfer binders.

The disadvantages of the loose-leaf system are reproduced more strongly in card ledgers ; the danger of loss and substitution is greater but the method is absolutely necessary in some classes of business. One great drawback is the uncertainty of the card and loose-leaf ledger as evidence in a Court of Law.

Work the following exercise :—

Exercise

Avoca, Limited, was registered in 1912, with an Authorised Capital of £200,000, divided into 100,000 Five per cent. Cumulative Preference Shares of £1 each, and 100,000 Ordinary Shares of £1 each. Of this Capital, 30,000 Preference Shares and 60,000 Ordinary Shares were issued and fully called up.

On December 31, 1914, the following balances appeared in the Books of the Company :—

BALANCES, DECEMBER 31, 1914.

	£	s.	d.
Sundry Creditors	34,306	–	–
Leasehold Premises	84,200	–	–
Four per cent. Debenture Account	50,000	–	–
Reserve Fund	30,000	–	–
Calls in Arrear (Ordinary Shares)	500	–	–
Freehold Premises	98,650	–	–
Leaseholds Depreciation Fund	1,500	–	–
Sales	52,980	–	–
Do. Returns	129	–	–
Purchases	16,856	–	–
Do. Returns	628	–	–
Sundry Debtors	9,580	–	–
Stock (31/12/13)	8,786	–	–
Patents	1,500	–	–
Plant and Machinery	8,680	–	–
Profit and Loss Account (Credit Balance, 31/12/13)	9,650	–	–
Bills Receivable	1,290	–	–
Salaries	3,820	–	–
Advertising	2,980	–	–
Carriage Inwards	1,196	–	–
Investments	7,264	–	–
Cash at Bank and in Hand	4,920	–	–
Manufacturing Wages	10,860	–	–
Debenture Interest Account	1,000	–	–
Transfer Fees	100	–	–
Heating and Lighting	628	–	–
Discount on Debenture Issue Account	1,250	–	–
Manufacturing Expenses	1,284	–	–
Directors' Fees	1,250	–	–
Rates, Taxes and Insurance	921	–	–
Carriage Outwards	2,460	–	–
Interest on Investments	420	–	–
Reserve for Bad and Doubtful Debts (31/12/13)	420	–	–
Five per cent. Cumulative Preference Shares Account	30,000	–	–
Ordinary Shares Account	60,000	–	–

You are required to prepare Trading and Profit and Loss Accounts for the year ended December 31, 1914, and a Balance Sheet as on that date.

When preparing these Accounts, the following instructions must be taken into consideration :—

1. Debenture Interest for the half-year to December 31, 1914, is to be provided for (ignore Income Tax).
2. £1,000 is to be added to the Reserve Fund.
3. All interest from Investments is to be added to the Reserve Fund.
4. £200 is to be added to the Leaseholds Depreciation Fund.
5. Ten per cent. Depreciation is to be written off Plant and Machinery Account.
6. Twenty per cent. Depreciation is to be written off the I atents Account.
7. The Interest on the Company's Investments accrued as on December 31, 1914, but not received, amounted to £120.
8. £250 is to be written off the Discount on Debenture Issue Account.
9. The Reserve for Bad and Doubtful Debts is to be increased to an amount equal to 5 per cent. on the Trade Debtors.
10. Rates paid in advance and Insurance unexpired amounted to £40 as on December 31, 1914.
11. The investments, having depreciated in value, are to be written down to the extent of £2,000, which amount is to be transferred from the Reserve Fund.
12. The Stock on hand, as on December 31, 1914, was valued at £6,410.

(London Chamber of Commerce.)

Key :— Gross Profit .. £20,907
Net Profit £7,011
B/S Total .. .. £220,007 F. H.

Continued from page 64.

ENGLISH LANGUAGE AND LITERATURE:

Contributors:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

NINETEENTH CENTURY POETRY.—II

WHILE the influence of Wordsworth, though gradual, was profound and lasting, that of Scott, as a poet, was instant and widespread, if comparatively wanting in depth. By the year 1810 Sir Walter Scott had brought poetry into a more general popularity than it had reached in any previous age. He had made it a recreation of the average reader.

Walter Scott (created a baronet in 1820) was born in Edinburgh, August 15, 1771, son of a Writer to the Signet. He descended, on both sides, from bold Border families, with traditions defiant of the law which now provided the family with a profession. When he joined his father as an apprentice to the law his head was already crammed with the romantic balladry of the Border, where he had spent much time in recovering from a delicate boyhood.

Sir Walter Scott

It was this Border literature, and the reading, while still a boy, of Percy's *Reliques of Ancient Poetry* that gave his life its literary bent. For seven years the lawyer's holidays were spent in collecting ballads preserved in country places; and the publication of them was begun in 1802 under the title *Minstrelsy of the Scottish Border*. Three years earlier Scott had been appointed Sheriff of Selkirk. In pursuit of his literary antiquarianism he studied the principal continental languages to master their ballads and the romances they preserved, and he translated some German illustrations.

Then, suddenly, the popular sporting lawyer and antiquarian sprang into national fame. His *Lay of the Last Minstrel*, published in 1805, sold six large editions in two years, and convinced its author that he must devote himself to literature, though he continued to hold his legal appointments, to which, almost immediately, a Principal Clerkship of the Court of Session was added.

From this time Scott's industry was fourfold. First his legal duties demanded about half his time. Meanwhile he was engaged on prose writings as biographer, critic and editor; and simultaneously was writing his poems, and later added his novels.

In 1808 appeared *Marmion* and also the Life and Works of Dryden in 18 vols. *The Lady of the Lake* in 1810 carried Scott's verse to its high water mark. There was a decline in freshness and interest, through *The Vision of Don Roderick* (1811), *Rokeby* (1813), and *The Bridal of Triermain* (1813). During the writing of these poems Scott was working on his *Life and Works of Jonathan Swift*, in 19 vols., published in 1814, simultaneously with *Waverley*, the first of his great novels. In the three years that followed *The Lord of the Isles* and *Harold the Dauntless* were produced alongside *Guy Mannering*, *The Antiquary*, *The Black Dwarf* and *Old Mortality*.

Stories in Verse

Scott now relinquished poetry, but during the remainder of his life accompanied his enormous output of fiction with prose works —*Lives of the Novelists* (1821-4), *Life of Napoleon*, 9 vols. (1827), and *Tales of a Grandfather* (1828-31), about Scottish and French history.

The need for this industry came from the failure of a printing and publishing firm with which he had entered into a partnership, and his heroic effort to pay off the whole debt of £130,000—a result finally attained, but not before the debtor had worked himself to death. The end came at his beloved house of Abbotsford, near Melrose, September 21, 1832.

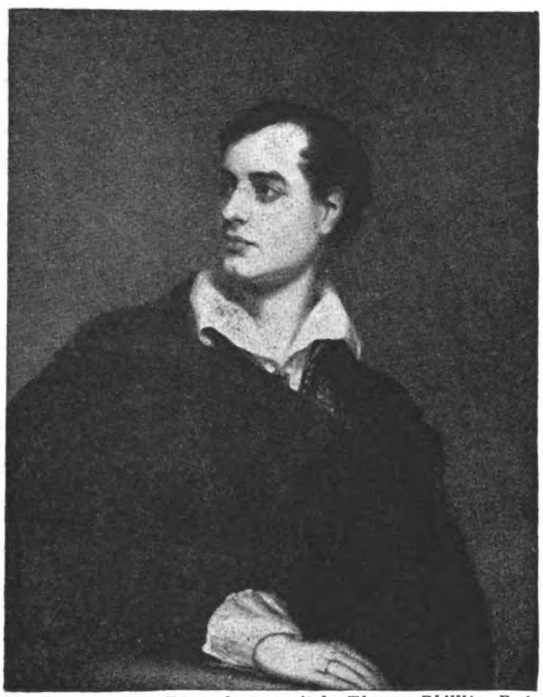
From the painting by Thomas Faed, R.A.

SIR WALTER SCOTT AT ABBOTSFORD

with a company of his friends—James Hogg, Henry Mackenzie, John Wilson, Rev. George Crabbe, John Lockhart, William Wordsworth, Lord Jeffrey, Sir Adam Ferguson, Thomas Moore, Thomas Campbell, Sir William Allan, Sir David Wilkie, Archibald Constable, James Ballantyne, Sir Henry Jardine and Lord Commissioner Adam.

As a biographer and critic Scott displayed conscientious industry and massive commonsense. His position as the greatest British novelist is discussed in Vol. IV., pp. 313-4. While no one would rank him as a poet with Shakespeare, Milton, Chaucer, Spenser, Wordsworth and Tennyson, it would be a narrow view of poetry that denied him a place at least as high as his ambition aspired. He was under no illusion as to the range of his powers. He was a vigorous writer of songs with a genuinely lyrical note, and a robust teller of a story in verse, staged in a romantic setting.

The Lady of the Lake is the brightest narrative poem in the English tongue. With *The Lay of the Last Minstrel* and *Marmion* it completes the record of Scott's distinctive verse of an elaborate kind, for his other long poems are comparatively commonplace. Animated by the romance of his themes Scott pressed on his story with a speed only made possible by his fluency. He pours forth his tale in an "unpremeditated lay." If it lacks profundity and the finer delicacies of literary art, it is honest, rousing, unaffected, and has power to grip the plain-minded people who make up the staple of mankind.



From the portrait by Thomas Phillips, R.A.

LORD BYRON (1788-1824),

a poet popular rather than great, and one of the most romantic, though wayward, figures of his age.

Through his romantic verse the poet found his way to the most natural medium for the expression of his genius, namely, the prose of fiction. Though he ceased to write extended poems fifteen years before his death, Scott continued to the last to embellish his tales with apt songs, and to mystify his readers with original mottoes in verse from non-existent Old Plays.

George Gordon, sixth Lord Byron, the most popular English poet during his lifetime, and still with the exception of Shakespeare the most popular English poet on the continent of Europe, was born in London of Scottish parentage, January 22, 1788. On the side of both his father and his mother he came of a wild and irresponsible stock, and his upbringing was a heavy handicap. He was reared in poverty by his mother, whose capricious affection veered between foolish petting and passionate restraint. By her carelessness during his infancy he was lamed for life with a deformity of his feet, a defect of which he was bitterly conscious. At the age of ten he succeeded to the title. Spoiled, sensitive, proud and poor, he was encompassed by disadvantages which must be understood with sympathy if his character and career are to be judged with justice.

While he was a boy at Harrow he printed privately some *Fugitive Poems*, and before he became of age published his *Hours of Idleness*, which reintroduced some of his earlier poems. This feeble book of youthful exercises was attacked unmercifully by the *Edinburgh Review*, then edited by Jeffrey, who affected to regard unwarranted intrusion into print as a crime. Byron had already begun to write a satire in the style of Dryden and Pope, and this he finished and turned into a retort on his critic under the title *English Bards and Scotch Reviewers*. Notwithstanding its singular lack of critical discrimination this sporting reply from a precocious youth amused the public, and disclosed a mental vigour far excelling any promise in the *Hours of Idleness*.

Two years of travel followed in the countries around the Mediterranean, and on his return the poet published, in 1812, at the age of twenty-four, the first two cantos of his *Childe Harold's Pilgrimage*, and sprang at once into a sensational popularity unwarranted by the merits of the book. Descriptive travel in verse was a welcome innovation, and two of the four lands visited—

Portugal, Spain, Albania and Greece—were familiar in every reader's thoughts. Then, too, the Spenserian stanza had its attractions; and the personality of the traveller, Childe Harold, or as he had been originally named before publication, Childe Burun, or Byron, a reckless, disillusioned youth, embittered by the harshness of a world he despised, appealed to the sentimentalism of the period.

Photo: D. McLeish.

THE MOCENIGO PALACE,

on the Grand Canal, Venice, a sixteenth century house which Lord Byron occupied in 1818. During his residence in Italy the influence of Italian models had a profound effect upon the poet's work.

For three years the new poet was the "lion" of society, at a time, be it remembered, when that contemptible dandy the Prince Regent, afterwards George the Fourth, was the social figurehead. On Byron was lavished the sham admiration of a shallow-minded clique, which viewed with special delight his theatrical posturing as a distempered profligate. Before this dangerous audience he played his part by distantly imitating Scott's tales in verse, but in a Levantine setting, with himself as a constantly renamed hero of romantic love episodes. *The Giaour*, *The Bride of Abydos*, *The Corsair*, *Lara*, *The Siege of Corinth*, and *Parisina* are all of this character.

In 1815 Byron married, unhappily. Legends to his discredit began to circulate; he quarrelled with his wife and they separated; the adulatory crowd now began to chill him with cold disapproval, and gave him a real experience of the world's scorn which hitherto he had appropriated only through his egotistical imagination. In 1816 he left England in a fit of disgust and never returned.

The next seven years of the poet's life were passed in Italy, which he reached by way of Belgium, the Rhine, and Switzerland. They were years of almost continuous literary industry, varied by reckless living which he advertised and magnified. In 1823 he went first to the Ionian Islands and then to the Greek mainland to assist in the movement to secure the freedom of Greece, and in 1824 (April 19) died there. He is buried in Hucknall Torkard church, Nottinghamshire, close by his ancestral home, Newstead Abbey, which he had sold in 1817.

The distinctive Byronic tone was perpetuated in *Manfred*, written under the combined influence of Goethe and of Swiss mountain scenery. Manfred is Byron masquerading as Faust, amid a cloud of attendant spirits, through a powerful melodrama ornamented with true poetry. The same tone—that of the rebel mind—is carried into the boldly imaginative Mystery *Cain*, but softened by tender human interludes.

Byron was devoid of the constructive dramatic instinct, and proved it in four tragedies, *Sardanapalus*, *Marino Faliero*, and *The Two Foscari*, all published in 1821, and *Werner*, 1823.

His residence in Italy naturally drew his attention to Italian literary models, and he began to adopt Italian measures for his poems, to translate Italian verse, and to write on Italian literary history, as in his *Lament of Tasso* and his *Prophecy of Dante*, dealing with Tasso's imprisonment and Dante's exile; and, an Italian measure, the *ottava rima*, was used for *Beppo*, *The Vision of Judgment* and *Don Juan*. In this measure he shows a mastery of bright, graceful, flexible verse, pre-eminently fitted for satire, that is unapproached by any other British poet.

Satire alone can never place a poet in the front rank of poets, but Byron availed himself of all it can do. No other English poet has the same easy command of cynical raillery with an undercurrent of good sense.

J. D.

POLITICAL ECONOMY.—IV

MOLINARI, the French economist and editor of the *Journal des Economistes*, tells us: "Man is an organism composed of vital, physical, intellectual and moral forces. This matter and these forces which form the individual and the species can only be preserved and developed by assimilation, or to use the economic term, the consumption of materials and forces of a like nature.

"Failing this consumption their vitality wastes, and is finally extinguished. But waste and extinction of vitality causes pain and suffering which impels man to acquire the materials necessary for the development and preservation of life. All these materials are present in his environment, air, etc., and nature gives him a small number free of cost. But with the exception of this minority, they must be discovered, acquired and adapted to the purpose of consumption."

The Principles of Barter

We have quoted this brilliant author fully as he appears to have given the groundwork of natural competition—or may we say inherent human competition?—more clearly than any other writer. Competition is in a great measure responsible for prices, and as prices are the factor in the distribution of commodities or production, it is essential that we get to the very root of the subject.

Self-preservation is the inducement to man to produce the necessities of life and commodities which have an exchange value.

Primitive man provided the necessaries of life by hunting; if he wished to live he must provide food, and even then we find the skilful hunter, or the man who could provide more food than he required for his own consumption, and the man who possessed skill of another kind. The skilful hunter exchanged his surplus with his less skilful neighbour for some other commodity which he desired. It might be a canoe or some other article.

As civilisation progressed, agriculture increased and the wealth of a country was often measured by the number of cattle it possessed. An ox was exchanged for another commodity, but this was found to be an exceedingly clumsy method, as can be easily imagined. One man might have a particular commodity he wished to dispose of and need another commodity. It was not always easy to find another man who required what he had and was able to supply what he needed. This system of exchange is known as barter, and is even now indulged in by some schoolboys.

As civilisation advanced, the difficulty of carrying on a system of exchange became more complex. Economists give various examples, but one will be sufficient to illustrate the problems which would arise.

A bootmaker wants beef. The first butcher he goes to has beef, but does not want boots. He proceeds further and finally finds the butcher who wants boots and has beef. The bootmaker has a pair of boots, but he only wants 2 lb. of beef and he is not disposed to give his pair of boots for 2 lb. of beef. One boot is no use to the butcher, so the bootmaker must take the 10 lb. of beef for his pair of boots and exchange what he does not require for wheat or any other commodity which he does require.

The system was not only clumsy but wasteful, and led to innumerable difficulties, until the system of accepting some substance as a medium of exchange was adopted by the universal consent of Society.

The earliest mention of this system appears to be the use of cubes of pressed tin in China, shells called cowries in Africa, and in some countries a metal disk embossed with an ox.

Gold Standard and Currency

The advantages of money are not confined to its being a means of exchange and a measure of value; it has also various other advantages, among which may be mentioned that it is easily stored and it is a standard for deferred payments or the credit system. Money also should have the following desirable qualities: General acceptability; desirability; divisibility; uniformity and steadfastness of value.

Gold is the basis of our money or currency. A gold coin contains the quantity of gold it is said to represent, and is only exchangeable for that value, i.e. a sovereign changes for the value of the gold it contains—an old and worn sovereign is not as valuable as a new one.

Our silver and bronze coins, however, have a value settled by law. Twenty shillings will exchange for a sovereign, not because a shilling contains a shilling's worth of silver, but because the law says that twenty shillings are equivalent to a sovereign, and twelve pennies are equal to one shilling.

We may now proceed with a definition of price as distinct from value. Price may therefore be defined as "the value of a commodity estimated in money." A general rise of prices may be attributed to the more

rapid growth of money, or to a falling off in the supply of goods, or to a combination of the two.

As we have seen, there may be a variation in the value of certain commodities, but there cannot be a general rise in values although there may be a general rise in prices. The prices of goods depend on demand and supply. As a general rule demand increases as prices decrease, and conversely demand decreases as prices rise.

If six people require a house, the price of that house will be the highest sum that one of the purchasers is prepared to give; if that price is such as to provide a greater reward to the builder for the capital invested the supply of houses will be increased immediately and the price will only be maintained so long as the demand continues.

Sources of Money

The same law applies to all goods except, of course, agriculture or the supply of foodstuff: the demand is more uniform and the supply is the regulator.

Manufactured goods are exposed to temporary reverses and contingencies produced by the removal of capital from one employment to another, to the influence of fashion, prejudice or caprice, as they not only supply the wants but must satisfy the taste of the purchaser.

The imposition of a tax, the effects of war, may so raise the freight and insurance that it is no longer possible to supply the goods at a price which will tempt a purchaser; demand ceases and not only the manufacturer, but those who have been engaged in manufacturing the goods, will suffer a loss which will be felt until the labour and capital can be removed to a channel where demand is in excess of supply.

Sudden changes, however, although they entail great loss in some cases, and in others great gain, gradually revert to normal price, which is regulated by the cost of production.

The main or normal source of money is the payment for goods previously sold, but the quantity of money is also reinforced by the production of new gold which is coined and stamped and becomes money. The miners, however, receive payment for this new gold either in actual money or increased credit, and although there is an added volume of purchasing power, there is no equivalent increase in the production of goods.

An increase in the supply of money or an increased volume of credit which is not the result of the sale of goods, tends to raise prices. Mr. J. A. Hobson, in his book *Gold Prices and Wages*, gives some interesting and instructive figures showing the increase in gold supply from 1851 to 1910, to which the reader is referred for fuller information.

Mr. Hobson states: "It can be shown that since 1896 the increase of new gold coming in as purchasing power and the new volume of credit (unaccompanied by a corresponding growth of goods) form a large enough addition to the aggregate supply of money to explain a rise of prices amounting to some 20 per cent.

A rise in prices is generally accompanied by a rise in wages, but statistics show that the rise has not benefited the wage-earner. If we take the figures from the year 1900, the rise in wages is equal to ·3, while the rise in the price of food and drink is 11·6, or a very decided loss in real wages. The greatest advantage to the wage-earner then is in production on such a scale as to keep prices normal or low and the purchasing power of his earnings will be greater.

Wages and Prices

Wages of course differ in different employments. Where the supply of labour is greater than the demand, wages (subject to trade union regulations with which we shall deal subsequently) will be lower than in other trades which do not attract large bodies of labour, either on account of its disagreeableness, the difficulty in learning the trade, the uncertainty of the employment or the risky nature of the work.

We have now had a brief outline, and it is necessarily a very brief outline, of the principles which govern the rise and fall in prices of goods and its effects on wages, but there are other factors which must not be overlooked. We have already mentioned unproductive labour.

An instance of this kind of enterprise would be a coal mine which did not yield coal in sufficient quantities to continue working: the labour has been employed and the wages have been paid out of floating capital, a quantity of money has been exchanged, but the equivalent in goods has not been produced. There would consequently be a shortage in this particular market which would have the tendency to raise prices without raising wages.

The standard to be aimed at is, as we have before pointed out, to secure an equilibrium of forces, to give labour its share in the exchange value of goods, and to reward capital for abstinence and risk, or in other words, to allow the cost of production to govern prices. J. W. U.

ETHICS.—II

THE principal forces in relation to human life with which Ethics deal are: Instinct, heredity, environment, will power, impulse, emotion, and action. There are, as a matter of fact, many more influences than these at work, and yet others which represent subdivisions of those mentioned here. But these seven are undoubtedly the chief, and they will suffice to explain something of the theories which we are now investigating.

When a child is first brought into the world its intellect is, of course, totally undeveloped, and it is entirely without the power of reasoning. But from the very instant that the helpless little creature first sees light it is endowed with *Instinct*.

The force of instinct requires very little explanation, which is just as well, for it is not an easy matter to define. Perhaps one may say that instinct is something passed down to the human being in an unbroken stream from the back of the ages. It is a faculty of *unconscious knowledge*, acquired quite independently of learning or experience.

A Child's Instinct

Any infant, for instance, will instinctively clutch an object placed in its hand, as it will instinctively turn to its mother's breast. Fear and anger in an infant partake almost entirely of the instinctive force, while the early tendencies to curiosity and gregariousness are likewise examples of the same faculty.

Instinct, moreover, is by no means confined to childhood, for the sex instinct is not experienced until the atmosphere of childhood has passed away, and the parental instinct does not make itself felt until later still. Now, instincts being part of the animal nature of man, it might be supposed that the sooner they are pushed into the background the better. But this does not seem to be so. It is preferable that instincts should be trained and placed at the service of the higher gifts of man.

The results of this are perfectly simple, and yet not a little wonderful at the same time. To take a few examples haphazard, from the instinct of curiosity springs scientific research; from mere unreasoning anger is evolved the warm enthusiasm to fight the wrong, while, on the other hand, even the primal shudder of fear can be trained into a dread of evil. It is considered that some of the noblest characteristics of man have their origin in these instincts, and that it is largely upon the way in which they are trained that depends the future character of the grown person.

We may now leave the subject of instinct, and pass on to a later stage of the child's life. We change now from the general to the particular. That is to say, that while instinct is expressed in exactly the same fashion in all human beings, this is not the case with the later forces.

The first one of these to be considered is *Heredity*. We have said that instinct is something that is passed down to human beings in an unbroken stream. Heredity has some aspects in common with this, but it is chiefly important in providing a link between one generation and another.

Temperamental Heredity

Heredity is a twin force. It works both physically and temperamentally. There is no need to dilate on its physical aspects, very curious though these prove themselves at times, more especially when the force of heredity, having apparently worn itself out, has reappeared, as powerful as ever, having skipped one or more generations. We are all familiar with the fact that a parent possessing any prominent feature tends to bequeath it to the offspring. There are certain laws influencing physical heredity. Thus a man who is unusually tall will in all probability beget a tall son.

Temperamental heredity deserves a lengthier survey. It is an attribute of man which has been explained in various fashions. Weissmann, for instance, has it that "in development a part of the germ-plasm contained in the parent egg-cell is not used up for the construction of the body of the offspring, but is reserved unchanged for the formation of the germ cells of the following generation."

Such theories as these may be accepted or not at the discretion of the student. There are doubtless a certain number of people who will object that an analysis of this kind leads to conclusions incompatible with the teachings of scripture. But there does not seem any real reason why anything of the kind should result, unless the student has previously determined to shape his arguments in that direction. It does not seem necessary to deny the works of God merely because an attempt is made to regard as closely as possible the marvellous manner of their achievement.

The practical workings of temperamental heredity are plain enough, of course. Thus a man possessed of great intelligence will transmit this faculty to his son in the ordinary

course of events, and so on, according to the various degrees of brain power. Sometimes it is remarked that a man of genius will have ignorant, plodding, and heavy-speeched parents. But this does not disturb the theory of heredity in the least; for the parents may never have had the opportunity of displaying a brain-power, which has thus lain fallow and unsuspected. For it is one of the laws of heredity that it is the power alone which is transmitted, and not necessarily skill in the particular art or craft which serves as a channel for the power.

Thus, a great soldier may have an offspring to whose temperament the military idea is completely repugnant. His gift may then develop in the direction of engineering, surgery, music, or any other occupation. On the other hand, if his surroundings and training are unfavourable, his talents may not develop at all, and he is likely to be regarded as a "failure," who has never had it in him to do the things his forbears have done.

The Factor of Environment

This brings us to the important factor of *Environment*. Heredity and environment constitute two of the greatest forces of early childhood. The extraordinary power of environment is by no means confined to mankind. The animals provide us with some very instructive instances. It is the power of environment which has taught the rabbits in Australia the art of climbing, in order that they might surmount the wire fences which acted as such inconvenient barriers. Then there is that which is occasionally called the Protective Working of nature. This is evident in many widely different directions. It is responsible for the whitening of the winter fur of the fox and hare in northern and snowy lands. It has brought into existence creatures such as those known as leaf-insects and stick-insects, the frames of which are only to be distinguished with the greatest difficulty from the leaves and sticks that they imitate with such wonderful accuracy.

It is quite true that the protective force of nature is at work here. At the same time, these instances really fall within the category of the powers of environment as displayed in the animal world.

From this it will be seen that environment manifests itself in a physical way in the animal world. But in the world of men the social side is of far greater importance than the physical. So the workings of environment on mankind affect the temperamental side. It is owing to this that it is impossible to attach too much importance to the associations of childhood.

In general, however, it may be said, that heredity and environment work together to mould the child's character. Their respective forces, of course, are by no means evenly distributed. In some cases the power of environment asserts itself with wonderful ease; in others the potency of heredity is such that it continues to crop up notwithstanding the most powerful influence of environment.

Some rather striking examples of this kind of thing were evident in New Zealand among the last generation of the children of mixed marriages between whites and Maories. The majority of these would live perfectly happy amid the European surroundings of their life. But there were cases of college-bred men and well educated and popular girls who felt the "call of the bush" so deeply that they forsook all the comforts and associations of their more complicated life, and went to live in the Maori Pahs in the bush, where existence was of the simplest, and where at times the calls on the intellect were practically non-existent.

This demonstrates a striking victory of the force of heredity over environment.

Influence of the Will

Having now reached this point, the student may well pause, and possibly take exception to the far-reaching influences which have been very roughly described here. If the child's character, he may protest, is made up of the forces of heredity and environment, what is there left for the child himself to do?

Decidedly, if matters were left at this stage we should be dealing with pure fatalism and the world would be lacking in all its vital interests of struggle and endeavour. But there are far more than these two factors at work in the life of a child and in those of his elders as well.

We have now arrived at the stage where *Will Power* enters upon its work, and where the initiative passes from these two influences to the free personality of the child. When will power comes into play the other two should, up to a point, become subservient to it. They represent material on which the child can work by the instrumentality of his will power.

The consequence of this is of the very first importance. We have seen that the child's gift of heredity is in the nature of a loan which he has to pass on. W. H. K.

Continued from page 72.

HISTORY:

Contributors:—J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.

THE DOWNFALL OF NAPOLEON

THE strong hold which the dynastic idea had obtained over Napoleon's mind culminated in his treatment of Josephine. Though notoriously unfaithful, he was really attached to his wife, but the lack of children was a bar to his schemes, and in December, 1809, the Empress was divorced. In April, 1810, Napoleon married the Austrian Archduchess Marie Louise. The step was unpopular in France and the tone of the Court became still more aristocratic and reactionary, but the birth of a son in March, 1811, was hailed by Napoleon as securing the permanence of the Empire.

The Peninsular War

During the years 1810 and 1811 France was at peace, save for the maritime war with England and the protracted struggle in the Peninsula. In 1809, Wellesley had cleared Portugal of the invaders and defeated Victor at Talavera. In 1811, after defeating Masséna at Busaco, he retreated behind the impregnable lines of Torres Vedras, and emerged to drive the French once more back into Spain. The Spanish, constantly defeated in the field, kept up a partisan warfare which absorbed the energies of many French armies.

Meanwhile, friction had arisen between Napoleon and the Tsar. Alexander was jealous of Napoleon's encouragement to the Poles, and his designs on Turkey and the East; he had been alienated by the Austrian marriage and the demands for strict enforcement of the blockade against England bore hardly on Russian trade. A meeting between the two Emperors at Erfurt in September, 1808, left the Tsar suspicious and irritated. Early in 1812 he entered into agreements with Sweden and England, and in June Napoleon crossed the Russian frontier with an immense army collected from all the states of the Empire. Even Austria and Prussia were forced to contribute contingents.

The Russians, unable to face Napoleon in the field, retreated steadily before him. By the middle of August he was at Smolensk. Here he should probably have wintered, but his vast designs were no longer controlled by his former soundness of judgment. He dreamed of concluding the war in a single campaign, and pressed on towards Moscow.

But while more confident than ever in his destiny, Napoleon had lost the energy and decision of early years and on more than one occasion he threw away his opportunities. His arrangements for supply and equipment were deficient and it seems that the extraordinary burden he had imposed upon himself of superintending every detail of policy, organisation and strategy had broken down even his unique capacity. On September 7 he fought a frightfully bloody but indecisive battle at Borodino. On the 14th he entered Moscow.

After Moscow

During the next few days the city was burnt, probably accidentally. On October 18th, finding his position untenable, he commenced his great winter retreat, followed by the Russians and harassed by the Cossacks. The troops suffered frightfully from the cold and from want of food. Discipline went to pieces among the great mass of conscripts of different nations. With fearful loss he forced the passage of the Berezina, where the Russians opposed him, and in December the wreck of the Grand Army recrossed the Niemen, having lost nearly 400,000 men and about 1,000 guns.

The retreat from Moscow was not only the greatest military disaster in modern history, it was the signal for the uprising of Europe. The Grand Army with which Russia was invaded, composed of Frenchmen, Poles, Bavarians, Saxons, Westphalians, Prussians, Austrians, Italians, represented the military

From the painting by Meissonier.

THE RETREAT FROM MOSCOW, 1812.

Harassed by Cossacks, pursued by Russians, Napoleon's retreat across the inhospitable plains of Russia turned into the greatest military disaster in modern history. Napoleon led more than 400,000 men across the Niemen for the invasion of Russia. Only 20,000 returned.

domination of Europe by one man. The return of a few thousand starved and ragged stragglers not only revealed to Europe the appalling tragedy which had taken place, it awoke in the hearts of the subjugated nations the hope of liberation and revenge.

The British Government, who had no belief in the possibility of peace with Napoleon, were ready with subsidies, and a new coalition was rapidly formed. Bernadotte was bribed by Russia with the promise of Norway, and Sweden threw in her lot with the Allies. Much more important was the attitude of Prussia.

The humiliations of the Peace of Tilsit had awakened a passionate resentment in Prussian breasts. Great statesmen such as Stein and Hardenburg had persuaded the King to trust the people. Serfdom had been abolished, abuses swept away, education extended. Scharnhorst had reorganised the army, evading the restrictions which Napoleon imposed, by a short service system. Above all, the sense of German nationality had been aroused, and many of the intellectual leaders of Germany, notably Fichte, threw aside their cosmopolitan indifference. The King was cautious and vacillating but the popular enthusiasm pushed him on. In December, 1812, the Prussian contingent had concluded a convention with the Russians.

Campaign of 1813

In March, 1813, Prussia declared war. To meet this formidable coalition Napoleon had to organise another Grand Army. It was a terrible task, for the relentless conscription, often anticipating the classes of the succeeding year, had drained the life-blood of France and the French people were weary of war. Moreover, great numbers of veteran troops were tied down to Spain. In 1812, Wellesley had conducted a brilliant campaign, storming Ciudad Rodrigo and Badajoz, and defeating Marmont decisively at Salamanca. To make headway against the British, now reinforced by the efficient Portuguese battalions which they had trained, and at the same time to hold down the Spanish guerillas, required a force which could ill be spared from Germany.

In face of all these difficulties Napoleon organised a great army of French, Westphalians, Bavarians and Saxons. On May 2 he defeated the Allies in the battle of Gross-Görschen (also called Lutzen), and on May 20 again beat them at Bautzen. But his cavalry were weak and ill-trained, his marshals had lost much of their energy, and the victories were indecisive. On June 3 he agreed to an armistice. He desired time for negotiation, hoping to bring in Austria on his side. Austria, however, was by no means inclined to support him. Proposals for peace were put forward which would have left France the frontier of the Rhine and the Alps, Murat upon the throne of Naples and Jerome upon that of Westphalia, but Napoleon would not consent to give up Holland or to abolish the Confederation of the Rhine. On August 12, Austria declared war. Meanwhile Wellington had swept through Spain, defeated Joseph at Vittoria and was preparing to invade France.

The second campaign of 1813 was marked by timidity, hesitation and bad combination on the part of the Allies; but Napoleon's own strategy sank below its former level. Blucher, the one allied leader of energy and decision, defeated Macdonald at the Katzbach, and though Napoleon won a brilliant victory at Dresden, it came to nothing. Vandamme's corps was destroyed at Kulm. Bavaria joined the Allies.

Battle of Leipzig

In October, Napoleon was defeated with frightful loss in the great three days' battle of Leipzig. The Saxon troops went over to the Allies during the battle. In the Southern theatre of war, Wellington had driven Soult, fighting stubbornly, through the Pyrénées, and carried the war into France. Again the Allies offered terms, fearing to undertake the invasion of France. Again Napoleon refused them.

The Campaign of 1814 was marked by a recrudescence of Napoleon's genius. To the timidity, mutual jealousies and incompetence of the Allies he opposed extreme rapidity of movement, brilliant strategy and hard-hitting. But he had lost all sense of realities, he exhausted his resources in the endeavour to obtain an impossible victory, and he refused all terms which would amount to recognition of defeat. The nation would not resist to the last in support of the Empire and at length the Marshals themselves compelled Napoleon to make peace.

On April 6 he abdicated at Fontainebleau. He was allowed to retire, with the title of Emperor, to the little Island of Elba; Talleyrand negotiated the return of the Bourbons and on May 30 the Treaty of Paris was signed with Louis XVIII. It was decided that France should retain the early annexations of the Revolution, that England should restore most of her Colonial conquests, that Germany should become a Confederation and that Holland and Belgium should be

united. In September, 1814, a general Congress met at Vienna to re-settle the Map of Europe, and the diplomatic genius of Talleyrand secured for France a leading voice in the arrangements. But before the Congress could accomplish its task it was interrupted by the return of Napoleon.

The restoration of the Bourbons had been due rather to the exhaustion and weariness of the nation than to any enthusiasm for the monarchy.

Louis XVIII.

Louis XVIII., though an amiable and intelligent man, had neither a personality which appealed to the imagination of the people nor sufficient energy to cope with the difficulties of his task. His brothers and the bulk of the returned *émigrés* were men who had "learned nothing and forgotten nothing." The Constitution granted by the King on his return was fairly observed, but the feelings of the nation and especially of the army were offended by the blundering tactlessness of the administration, and when Napoleon landed in France on March 1, 1815, he found no opposition.

On the 20th he re-entered Paris and at once set about organising a gove nment and an army. In order to arouse the enthusiasm of the people he proclaimed a Constitution, and found himself saddled with a Liberal Lower House whose main desire was to avert a resumption of autocracy.

The nearest enemies were the Prussians, under Blucher, and a mixed army of English, Dutch-Belgians and Germans, under Wellington, both of which were in the Netherlands. Napoleon determined to destroy them before the Austrians and Russians could come up. His campaign was admirably planned. He passed the Sambre on June 16, separated the Allies, and on the 16th defeated Blucher at Ligny, while Ney engaged Wellington at Quatre Bras. But some blundering, apparently due to defective staff arrangements, left the first corps wandering between the two battlefields. Ney was repulsed and Napoleon's stroke at Ligny was not decisive.

A strange apathy, probably due to disease (though this is denied by Dr. Holland Rose), which fell on him after the battle, hindered the pursuit. On the afternoon of the 17th, Napoleon sent Grouchy to follow up the Prussians, while he carried the bulk of his force to attack Wellington. On the morning of the 18th, he moved forward to drive Wellington from his position. The French Army was homogeneous and full of spirit, but the events of 1814 had entailed much disorganisation, and many of the higher officers were distrusted by the troops.

The allied army contained some very untrustworthy elements, but Wellington had placed it in position with great skill, and he expected help from Blucher before he could be crushed. The fighting was desperate. The French attacks were made with determination but in general with little skill. The British Infantry, and those of the King's German Legion, stood their ground with unsurpassable heroism, though frightfully reduced by the fire of the superior French artillery, and a magnificent charge by the British heavy cavalry shattered the whole of D'Erlons' corps.

Meanwhile, Blucher, having left a single corps to keep Grouchy in check, was pressing towards the battlefield. By 7 p.m. the Prussians were gaining ground fast on the right rear of the French. The French cavalry had been recklessly used up by Ney in the effort to break the British squares, but Wellington's line had become perilously thin. Napoleon sent forward the Guard in a last effort to b eak it.

St. Helena

The attack was completely defeated and Wellington ordered his whole line to advance, putting in two brigades of light cavalry which formed his whole available reserve. The Prussians broke in fiercely upon the French right, and the defeated army, attacked in flank and rear, completely broke up.

The pursuit was entrusted to the Prussians, who were comparatively fresh, and was relentlessly carried out. Grouchy effected a masterly retreat with the troops under his command, but after Waterloo it proved impossible to get together a force capable of staying the invasion. The Austrians had crossed the Eastern frontier, the Russians were on the move. The Chambers were disinclined to continue a hopeless resistance and appointed a Provisional Government, of which Touché and Carnot were the leading members. Napoleon endeavoured to secure his dynasty by abdicating in favour of his son, but Touché had decided that the only hope of peace lay in submission to the Bourbons.

Paris capitulated to Wellington and Blucher on July 8, and Louis XVIII. returned to the Tuileries. On the 15th, Napoleon gave himself up on board the *Bellerophon*. It was felt that it would be impossible to run the risk of another "return from Elba," and he was exiled to the Island of St. Helena, where he died in May, 1821.

The second Treaty of Paris was signed on November 20, 1815. The Prussians, and many of the minor German states, were eager to dismember France, but Wellington and Castlereagh, who looked to the establishment of a durable peace, steadily opposed any such project and persuaded the Tsar to support them. The terms finally agreed included the payment of a war indemnity, the reduction of France to the limits of 1789 and the occupation of certain frontier fortresses for a period of five years. In fact the troops which garrisoned them were withdrawn in 1818.

This is not the place to go into the details of the complicated arrangements by which the Congress of Vienna sought to establish the stability of the European system. It accomplished much that was of value. It gave notable expression to the feeling of common interests between the nations of the European family and the desire for a system of international law; it provided wisely for freedom of navigation of rivers flowing

After the portrait by Sir Thomas Lawrence, P.R.A.; engraving lent by Messrs. T. H. Parker Bros.

THE IRON DUKE.

Arthur Wellesley, the first Duke of Wellington (1769-1852) who, with the sole exception of Napoleon himself, stands out on the canvas of history as the greatest soldier in an age of great soldiers.

through different countries ; it was induced by Castlereagh to make a declaration leading to the abolition of the slave-trade ; finally it so arranged the Balance of Power in Europe as to secure a period of general peace and recuperation.

The idea which Alexander I. had entertained of establishing a system of mutual guarantees, extending not only to territorial arrangements but to the existing systems of government, backed by an international force established by the Great Powers, broke down largely through the opposition of the British Government, which disliked the policy of intervention and distrusted the use which might be made of it by Russia and Austria. In truth the time was not yet ripe. The territorial rearrangements took no heed of the principle of nationality. Italy remained divided into petty states ; Germany was but a loose Confederation with the influence of Prussia predominant ; the extinction of Polish independence and the forced union of Belgium with Holland, created fruitful sources of future trouble.

Settlement of Europe

Yet in judging the work of the men who framed these schemes we must remember the paramount necessity of securing at least a period of peace after some twenty-five years of incessant warfare. The mutual jealousies of the Allies, the unreasonable claims of the crowd of petty princes presented an insuperable obstacle to any really satisfactory settlement. The best that could be done was to effect a compromise which should give the exhausted nations a chance to recover from the great conflict. And this at least was accomplished.

It seemed in 1815 that the wheel had come full circle since 1789. A Bourbon King sat upon the throne of France, Bourbon despotism in a far harsher and more reactionary form had been re-established in Spain and Naples. In Austria Metternich was pursuing a policy of pure obscurantism ; the Tsar had cast aside his earlier liberal views for the old idea of benevolent despotism ; the King of Prussia tended more and more towards autocracy. Even in England, the reaction from the revolutionary excesses of France had driven the government into an attitude of harsh repression.

But under the surface the great forces which had been liberated by the Revolution and carried throughout Europe by the arms of Napoleon, were at work. No reaction could deprive France of the broad results of the Revolution or the admirable work of the Consulate and early Empire. The abolition of feudal privileges, the nationalisation of Crown and Church lands, the improved condition of the peasants, the impetus given to trade and industry, the improved system of taxation, the Codes, the great public works, these remained to bear witness to the enthusiasm of the Assembly and the genius of Napoleon. More important still, the great principles of personal freedom and political liberty, of the sovereignty of the people and the claims of nationality had been asserted in a manner which made them a part of the moral and intellectual heritage of Europe.

French Autocracy Doomed

Europe in arms had proved unable to conquer France so long as she stood for liberty and nationality. When in her turn she attempted to enforce these ideas upon her neighbours she failed, and in the attempt France lost her own revolutionary character and passed into a military despotism. But the defeat of the French arms left the French ideas victorious. It was only when the national spirit and the desire for liberty were aroused in Spain, in Prussia, even in Russia and Austria, that the tide of invasion was rolled back ; and though the governments of the coalition reverted only too soon to the old despotic traditions the impulse which had been given to liberty and national sentiment was indestructible.

In every province which had shared the benefits of French administration there had taken place a quickening of political life which survived the reaction consequent upon French exactions. The Europe of the Nineteenth Century was to see a gradual decay of the old monarchical ideas and a parallel development of the principles represented by France and England—the real protagonists of the drama—liberty founded on intellectual activity and democracy on the one side, on the other a more gradual progress based on historical tradition and the love of order.

The history of France herself was to be coloured equally by the democratic enthusiasm of the Revolution and the administrative centralisation and vigour of Napoleon.

In 1815 the restoration of the Bourbons ended, so far as was possible, the work of the Revolution, and a common attachment to some at least of the principles of the Holy Alliance united Tory England with the men of the Restoration. Since 1815, a slow but growing cordiality has replaced the old tradition of international hatred. J. B. S.-B.

Continued from page 89.

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BOTANY.—XXII

DICOTYLEDONS—GAMOPETALÆ (*continued*).

64. Primulaceæ (*Primrose family*).—This order consists of a comparatively small number of genera, but a few of the species are familiar in the wild state or in cultivation: they have little or no economic value. The characteristics of the order are the actinomorphic flowers, with five stamens opposite to the petals, and a unilocular ovary with free central placenta. The order may be studied in the following genera:—*Primula* (Primrose, Cowslip, Oxlip, Polyanthus, Auricula); *Anagallis* (Scarlet Pimpernel) and *Lysimachia* (Yellow Pimpernel, Loosestrife, Creeping Jenny). The genera *Samolus* (Brookweed), *Hottonia* (Water Violet) and *Glaux* (Sea Milkwort) are much less common.

Examination of a bunch of primroses will show the flowers to be *dimorphic*, i.e. of two kinds. In one kind (the long-styled), the style is long enough to bring the stigma to the throat of the corolla-tube, well above the ring of anthers; in the other sort (short-styled), the anthers form a whorl at the mouth of the corolla tube, and the stigma does not reach so high (Fig. 163). Experiments on the pollination of the primrose seem to teach that the best results are obtained when the long-styled pollen fertilises a short-styled stigma, or vice versa; at the same time similar flowers cross-pollinate quite readily; and self-pollination also occurs. The flowers of cowslip are also dimorphic, and are grouped in umbels which droop, so that the insect enters the flower from below. As the cowslip grows in meadows along with grasses, its general habits form an instructive contrast with those of the primrose.

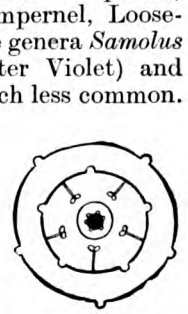


Fig. 162.—Floral plan of Primulaceæ.

The scarlet pimpernel is a common weed

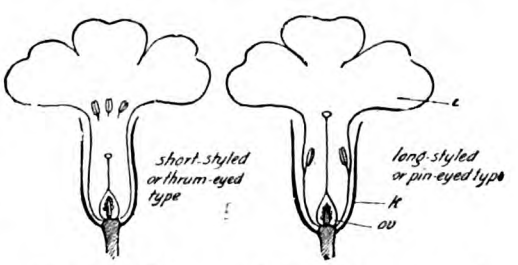


Fig. 163.—Diagram of dimorphic flowers of Primrose.

of cornfields or waste ground; its flowers close between two and three, or in wet and cloudy weather; hence its familiar name, the poor man's weather-glass. It has a short corolla tube, and can be self-pollinated. Its capsule dehisces by a cap. *Lysimachia* is a genus of creeping plants with yellow star-like flowers. The yellow pimpernel is common in woods; its flowers arise singly from the axils of decussate leaves.

65. Labiatæ (*Dead Nettle family*).—An order easily recognised both in the vegetative and in the floral parts of its members. All have square, generally hairy, stems with decussate leaves; the floral formula is K[5], C[5], A4, G[2]. The

corolla is strikingly two-lipped; the upper lip, often noticeably two-lobed, acts as a shield for the stamens and stigma, while the lower lip serves as a convenient stage for the pollinating insect, generally a bee. The stamens are *didynamous*, i.e. in two pairs of unequal length; while the two syncarpous carpels form a four-chambered ovary in the mature flower, which ripens into four achenes in the fruit. The four fruits, resting at the base of the cup-like persistent calyx, are a universal feature of this order.

Fig. 164.—Diagram of labiate.

The flowers are arranged in a kind of sessile cyme, called sometimes a *verticillaster*. In the axil of every leaf, such a cluster is formed, and the flowers open as shown in the diagram (Fig. 166), the central one always being first.

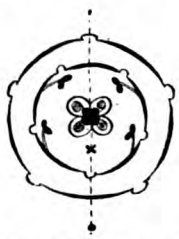


Fig. 165.—Floral plan of labiatæ.

The pollination of the flowers is usually not difficult to follow. Many species are more or less protandrous. The bee, alighting on the lower lip, seeks the nectary which is beneath the ovary. When the pollen is ripe, the filaments bend down, so that the anthers touch the insect's back; the forked stigma is bent into the same position at a different time, so that the insect must visit another flower, if pollination is to be effected.

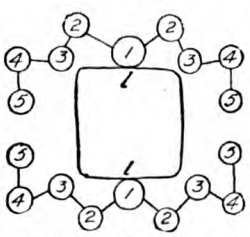


Fig. 166.—Diagram showing order of opening of flowers in labiatæ.

l.l. position of leaves.

Many species of Labiatæ are to be found abundantly, chiefly in hedgerows, woods or open fields. Some of the hedgerow species mimic the nettles in their general appearance, but have nothing in common with them except that fact.

In the same environment, they have evolved certain similar features. The genus *Lamium*, including the white and red dead nettle, and the yellow archangel, is a very common one everywhere, especially in hedgerows and shady woods. *Stachys* includes the woundwort, a nettle-like plant, with purple flowers and an objectionable smell; as well as the rather similar wood betony. *Ajuga* (Bugle) is familiar in woods. Thyme, Sage, Marjoram, Mint and Penny-royal all suggest a common type of Labiate, mainly small plants adapted to a scanty soil. *Prunella* (Self-heal) is common in meadows, and has its flowers in characteristic cymose clusters. *Lycopus* (Gipsywort) is frequent in wet places; and *Nepeta* (Ground Ivy) is common in all sorts of drier ground. Purple, blue-purple, and deep red are the commonest colours among Labiatæ, and are associated with the specialised adaptations of the flowers in other ways to the higher insects.

Fig. 167.—Ajuga (Bugle).

Boraginaceæ (*Forget-me-not family*) resemble Labiatæ in their fruits which consist of four achenes enclosed in a persistent calyx. But they are not square stemmed; their leaves are not decussate; their flowers are not two-lipped; and they have five stamens. The chief members of the order are *Myosotis* (Forget-me-not); Borage, Bugloss, Comfrey.

66. Scrophulariaceæ (*Snapdragon family*).—This order partly resembles the Labiatæ in the square, hairy stems and opposite leaves, in the zygomorphic flowers with their four didynamous stamens, and in the frequency of a two-lipped corolla. But it differs in the ovary, which is two-celled, and does not split into four divisions; the fruit is a capsule with many seeds, and dehisces, first septicidally into two fruits which in turn open by valves and have their seeds scattered by the "censer" method. There is also a wider range of flower-structure in this order than we find in Labiatæ. The mullein (*Verbascum*) has almost regular flowers, with five stamens; the speedwells (*Veronica*) have only two stamens, with corolla only slightly zygomorphic; but most of the other genera show the two-lipped structure, though variably, from its extreme in the snapdragon to its comparatively slight occurrence in the figworts.

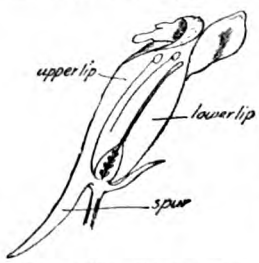


Fig. 168.—Diagram of flower of Toadflax.

Pollination is almost universally by bees, though the speedwells and mullein are also adapted to flies, and the protogynous figworts to wasps. The nectar is formed from a ring-like disk beneath the ovary and the position of the anthers is such that the insect is liberally dusted with pollen at the same spot as the stigma is adjusted to brush it off in another flower. Foxglove, Snapdragon, Monkey-flower and Toadflax are all worthy of careful study in this respect. The snapdragon and the yellow toadflax have personate corollas, in which the mouth is closed, so that only a strong and persevering insect can enter the flower.

Fig. 169.—Greater Mullein.

The order is a widely distributed and varied one, and a few genera only can be mentioned here. *Veronica* has many species, native or cultivated, small herbs or shrubby plants. The greater mullein is a large woolly plant with yellow flowers, conspicuous on the edges of woodlands and in hedgerows. *Digitalis* (Foxglove) is familiar to everyone. *Bartsia* is common on roadsides and waste fields, with its dull purple flowers; *Rhinanthus* (Yellow Rattle) is a native of meadows, with yellow flowers, and inflated calyx; *Euphrasia* (Eyebright) has small white flowers, with touches of yellow and violet, and is also a native of the meadows. *Linaria* (Toadflax) is sometimes called the wild snapdragon, but its personate corolla has a long spur on the lower lip. *Scrophularia* (Figwort) has two common species; both are large square-stemmed plants with small dull-purple flowers; the marsh figwort (*S. aquatica*) is particular in its damp habitat; but the knotted figwort (*S. nodosa*) is also common in hedges and damp ditches. *Antirrhinum*, *Calceolaria*, *Pentstemon* and *Mimulus* (Monkey flower) are commonly cultivated members of this family.

67. Other orders belonging to the Gamopetalæ and containing important species are the following:—

Solanaceæ containing the important genera *Solanum* (Bitter-Sweet, Potato and about 600 other species); *Atropa* (Deadly Nightshade); *Nicotiana* (Tobacco-plant); *Hyoscyamus* (Henbane)—all of them poisonous through the presence of narcotic alkaloids.

Plantaginaceæ, containing the plantains, with their protogynous flowers in dense heads.

Gentianaceæ, containing the genera *Gentiana* (gentians—bright flowers of alpine or semi-alpine character); *Erythræa* (Centaury—red flowers common in fields); *Chlora* (Yellow wort—with paired perfoliate leaves); and *Menyanthes* (Buckbean—a beautiful bog-plant).

Oleaceæ, a group of shrubs and trees chiefly, including Lilac, Olive, Privet, Ash; with two stamens in the flowers and a drupe for the fruit (except in Ash).

Fig. 170.—Fine leaved Heath.

Fig. 171.—Woodruff.

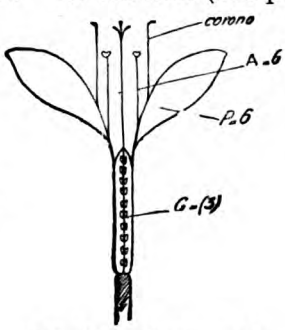


Fig. 172.—Diagram of Narcissus.

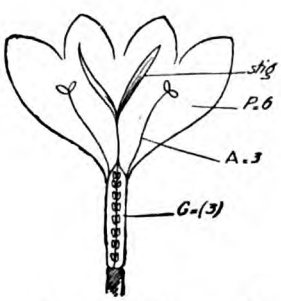


Fig. 173.—Diagram of Iris.

Ericaceæ, the Heather tribe, with characteristic urn-shaped corollas: containing the genera *Erica* (Heath); *Calluna* (Ling, Heather); *Pyrola* (Wintergreen); *Vaccinium* (Whortleberry).

Campanulaceæ, containing *Campanula* (Harebell, Canterbury Bell, Clustered Bluebell).

Rubiaceæ, with whorled leaves and small flowers as in the common goosegrass: contains the genera *Galium* (Goosegrass, Bedstraws); *Asperula* (Woodruff, with scent

of new-mown hay); *Rubia* (Madder); *Sherardia* (Field Madder—a small weed with pink flowers).

Caprifoliaceæ, chiefly shrubs, but also containing the little woodland plant, *Adoxa* (Moschatel). Included in it are *Lonicera* (Honeysuckle); *Sambucus* (Elder); *Viburnum* (Wayfaring-tree, Guelder Rose). The two last-mentioned genera have compound umbels of small flowers, producing berries.

MONOCOTYLEDONS.

68. Liliaceæ (*Lily family*).—The Lily family may be taken as a typical example of the petaloid Monocotyledons. The tulip previously examined shows the characteristics of the order. Most of the members have some kind of underground stem, e.g. a rhizome or a bulb; and the floral formula is regularly P3+3, A3+3, G[3]. The chief members of the order are the various lilies, Lily of the Valley, Tulip, Hyacinth, Bluebell,

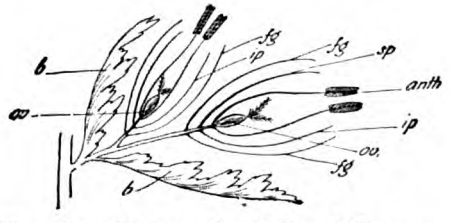


Fig. 174.—Diagram of spikelet of Cynosurus cristatus (dog's tail grass).

fg, flowering glumes; sp, superior palea; ip, inferior palea; anth, anther; ov, ovary; b, bracts of a comb-like involucre characteristic of the species.

Star of Bethlehem, Fritillary, Onion, Ramsons, Butcher's Broom.

Amaryllidaceæ resemble the Liliaceæ, except that the flowers are epigynous and the ovary inferior. *Narcissus* (Daffodil) has a conspicuous *corona*, a large tubular growth from the perianth (Fig. 172).

Iridaceæ resemble Amaryllidaceæ, but have one whorl of stamens missing. The crocus and the iris belong to this order; the iris has large petaloid stigmas which shield the anthers, and help to make the flower conspicuous (Fig. 173).

Orchidaceæ are a large order characterised by their gynandrous flowers and inferior ovary. The British species mostly have tuberous roots and favour damp places or dry downs as their habitat according to the species. Some tropical orchids are *epiphytes*, i.e. they grow perched up on trees, holding their own water supply in a special tissue around the roots. *Neottia* is a British orchid which is parasitic on the roots of trees. The genus *Orchis* is the commonest in Britain, and includes the Early Purple Orchis, the Spotted Orchis, the Pyramidal Orchis and others. *Gymnadenia* is the Fragrant Orchis, and *Habenaria* the Butterfly Orchis. The Fly Orchis and the Bee Orchis are both included in the genus *Ophrys*. *Listera* (Tway Blade) and *Epipactis* (White Helleborine) are also not uncommon.

Among Monocotyledonous orders are also to be noted:—

Naiadaceæ, the pond-weed tribe, a family of water plants with submerged or floating leaves and insignificant greenish flowers.

Alismaceæ, including the Water-plantain and Arrowhead.

Juncaceæ, rushes; with scaly perianth, and cylindrical leaves.

Typhaceæ, reeds; small flowers in spikes, with reduced perianth; tall unjointed stems and sharp-edged leaves.

Araceæ, containing the Arums, with their characteristic inflorescence.

Cyperaceæ, sedges; somewhat like grasses; but having triangular stems which are solid instead of hollow.

69. Gramineæ (*Grasses*).—There is as a rule no doubt about the identification of a grass in a general way, though the numerous genera and species are not always easy to distinguish. The roots of grasses are tufts of fibres, and in many there are also long slender branched rhizomes. The aerial stems are hollow haulms; and the leaves are linear, have a ligule, and sheath the stem from one node to the next. The flowers are small and are grouped in varying numbers to form *spikelets*, which in their turn are arranged as racemes or panicles. Each spikelet is subtended by two large scaly bracts known as *glumes*, and includes from one to three florets, each of which is enclosed in two scales or *paleas*. Each floret has three stamens with long filaments and large versatile anthers; the ovary is superior, with two styles and feathery stigmas. Sometimes two very tiny scales (*lodicules*) can be recognised beneath the ovary; these are the only rudiments of a perianth that are found. With these outlines the examination of a grass should not be difficult.

Among the commoner grasses are the cereals, Wheat (*Triticum*), Barley (*Hordeum*), Oats (*Avena*) and Rye (*Secale*); the Meadow grasses (*Poa*); Fescue (*Festuca*); Foxtails (*Alopecurus*); Bent-grass (*Agrostis*); Couch-grass (*Triticum repens*); Cocksfoot (*Dactylis*) Dog's Tail (*Cynosurus*); Darnel (*Lolium*); Timothy Grass (*Phleum*); Brome Grass (*Bromus*), etc. E. W. E.

GEOLOGY.—IX

Evidences of Earth Movement.—The reader will have become familiar with various phenomena which prove conclusively that elevation, subsidence, and lateral squeezing of the earth's surface materials have occurred again and again during the periods of geological history.

Raised beaches, and the existence, far above sea-level, of sedimentary rocks containing marine fossils, show that the land has been elevated relative to the sea. Submerged forests, coal seams, drowned valleys and some of the Pacific coral atolls all indicate subsidence.

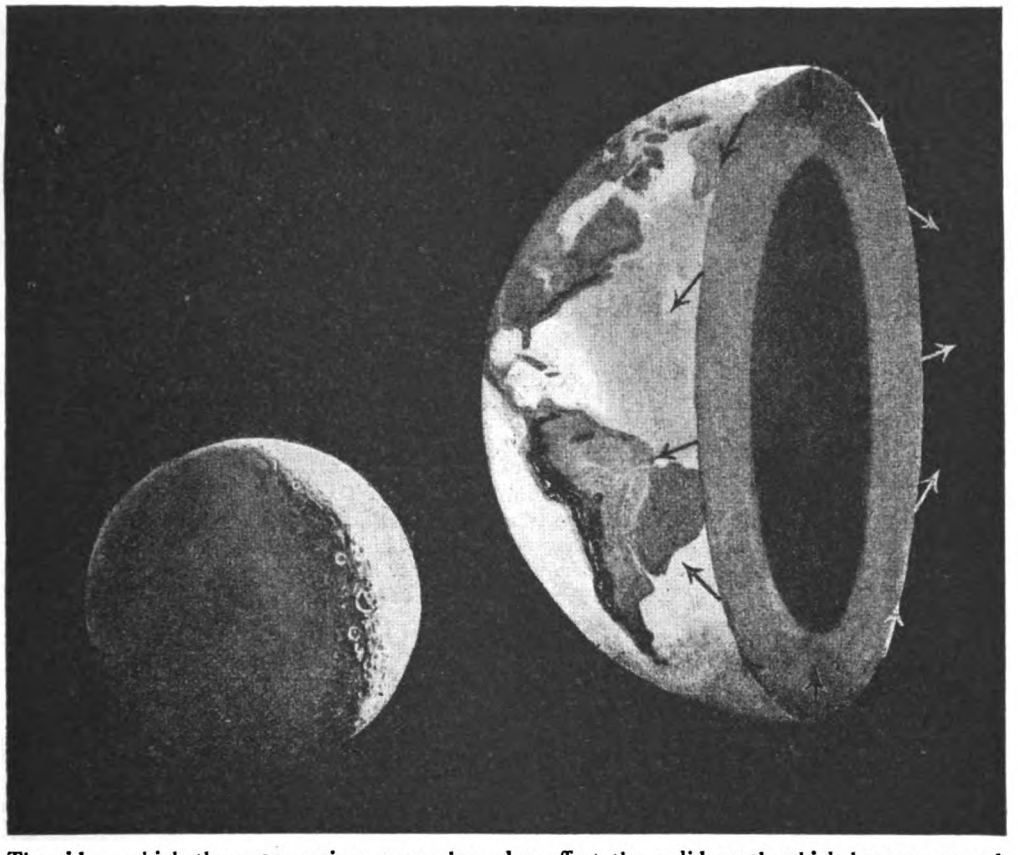
In striking contrast are the sudden movements which give rise to vibrations known as earthquakes.

Earthquakes.—When a sudden dislocation takes place in the earth's crust a wave-like motion emanates from the centre of disturbance and spreads in all directions, the shock, when it reaches the surface, being felt as an earthquake. In extreme cases the whole earth is shaken, and the waves before dying away may reach the antipodes of the point of origin, not only by rolling around the surface but, more quickly, by taking a direct path through the heart of the planet.

What are the causes of earthquakes? The earth is like a gigantic flywheel, rotating rapidly, and every disturbing influence tends to make it vibrate and quiver.

In the first place, the earth is not balanced perfectly on its axis, for the Poles wander in an irregular curve having a diameter of about 20 yards.

The tides every day raise great bodies of water which move between the limits of low and high tide marks. The tides also affect the solid earth which heaves slowly up and down in response to the diurnal passage of mighty stresses. London rises and falls eighteen inches every day.



The tides, which the moon raises every day, also affect the solid earth which heaves up and down in response to the diurnal passage of mighty stresses. London rises and falls eighteen inches every day!

Even falls of snow and rain disturb the balance of the crust and in some cases, so delicate is the interplay of forces, that mere variation of atmospheric pressure suffices to initiate slight tremors which in turn lead to considerable shocks.

The great majority of powerful earthquakes are, however, caused by the fracture and slipping of rocks in process of faulting. Superficial faults are sometimes caused by the slipping of great masses of sediment along the front of a delta, or on steep submarine banks.

Another class of earthquake, more limited in

its scope, is caused by movements of deep-seated magmas, or by the explosive emission of lavas and ashes due to sudden flashing into steam of ground waters encountered by the rising lavas.

It is wrong, however, to suppose that earthquakes and volcanic eruptions are generally intimately connected. Though minor shocks and tremors are naturally common in volcanic districts, the most powerful, destructive and widespread shocks occur where there is no volcanic activity to relieve the accumulated earth-stresses.

In Japan, for example, which is one of the most earthquake-ridden lands in the world, there are many volcanoes, but the earthquakes are most powerful away from the volcanic districts.

Speaking generally, earthquakes and volcanic eruptions are different manifestations of similar underlying causes. The tectonic earthquake is due to the relief of stress in solid, brittle rocks; the volcano relieves stress by the movement and expulsion of liquid rock—and incidentally, where the crater has been frozen and where new channels of escape must be forced, volcanic earthquakes arise.

The San Francisco earthquake of 1906 was due to movement along a fault which runs parallel to the Pacific coast and passes through the city itself.

The land on the Pacific side of the fault was thrust by sudden jerks towards the north and slightly uplifted, while on the east the movement was towards the south. The displacement of fences and railways showed a total movement of 8 to 20 feet.

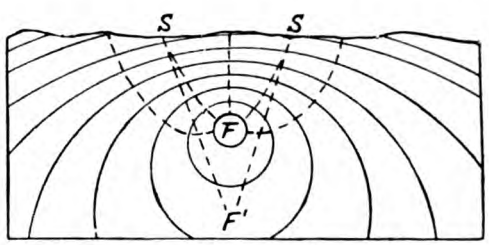


Fig. 52.—By projecting the lines of throw at S S the focal point F′ would be obtained. The true focal point, however, will be F, because the path of earthquake vibrations near the surface is not straight but curved.

The Distribution of Earthquakes.—The chief earthquake regions of the world are shown on the map given in Vol. II., p. 38, and prepared according to the records collected by the late Prof. Milne. It is clear from this chart that earthquake centres are mainly associated with the chief lines of earth movements followed during the last period of mountain building.

The greatest region of all, K, extends from the Alps to the Himalaya. One-fifth of the earth's greatest shocks originate within its limits.

The Malay archipelago is another unstable region, F, while to the north, from the Philippines to Kamchatka, is the region E which includes the earthquake centres of Japan.

The circum-Pacific line of weakness is completed by the three regions of the Western coasts of America. The West Indian area, C, probably owes its earthquakes to the shattering and sinking of the old continent of Antillia, the only remnants of which are the peripheral lands of Central America and the Archipelago.

Other foundered areas, H, I and J, which made the Northern Atlantic, are still characterised by sudden movements. In the same way the foundered land which once united Madagascar and India, is still unsettled, and earthquakes originate from beneath the floor of the western part of the Indian Ocean, G.

The Foci of Earthquakes.—All earthquakes have their origin within the upper ten miles of the crust. This is precisely what one would expect, for at depths greater than ten miles the pressure becomes so great that, at the temperatures which there obtain, no crevice or pore space would be possible in any rocks with which we are familiar.

Under immense stresses rocks become plastic and flow, just as lead does when it is drawn into piping. Consequently, below ten miles the rocks could not fracture, and earthquakes are only possible where fracture is possible.

The point of origin, or epicentrum, of an earthquake is determined by observing the direction of throw or thrust of objects at the surface. Immediately above the point of origin bodies are projected upwards. On all sides the throw becomes oblique, the angle depending mainly on the distance from the epicentrum.

The most destructive effects are frequently found where the angle at which the vibrational shock emerges is about 45°. By plotting the lines of emergence and projecting back into the earth, the various lines will usually meet in a region which gives approximately the position of the earthquake focus.

The position, however, will be too deep because the path of earthquake vibrations near the surface is not straight but slightly curved. Elasticity, temperature and density all increase with depth.

The velocity of vibrations is accelerated with the increase of elasticity and temperature, more than it is retarded by the increase of density. Hence in depth the velocity of an earthquake wave is greater than near the surface, and the path followed gradually curves upwards towards the surface. In projecting back the lines of emergence the depth implied is therefore too great and must be suitably corrected.

Types of Earthquake Waves.—Dr. Oldham has shown that the disturbances due to an earthquake may be analysed into three distinct forms of wave motion, which after passing around or through the earth, give rise to three different records in a distant detecting station.

The detection of seismic tremors which have been transmitted through the body of our planet is one of the most important achievements in the modern investigation of earthquakes by delicately balanced seismometers.

Of the three types of waves two pass deep into the earth, while the third is propagated around the surface. The two internal waves are due to

compression in one case and to distortion in the other.

While they traverse the heterogeneous and fractured rocks of the crust it is not possible to distinguish them, but when they sink into the homogeneous material that lies below, they can be sorted out by their different velocities, for they velocity of propagation varying between one and two miles a second according to the rocks traversed, the strength of the wave, and the distance from the epicentrum.

The Interior of our Planet.—The existence of a distortional wave proves that the interior of the earth is highly rigid, and that it

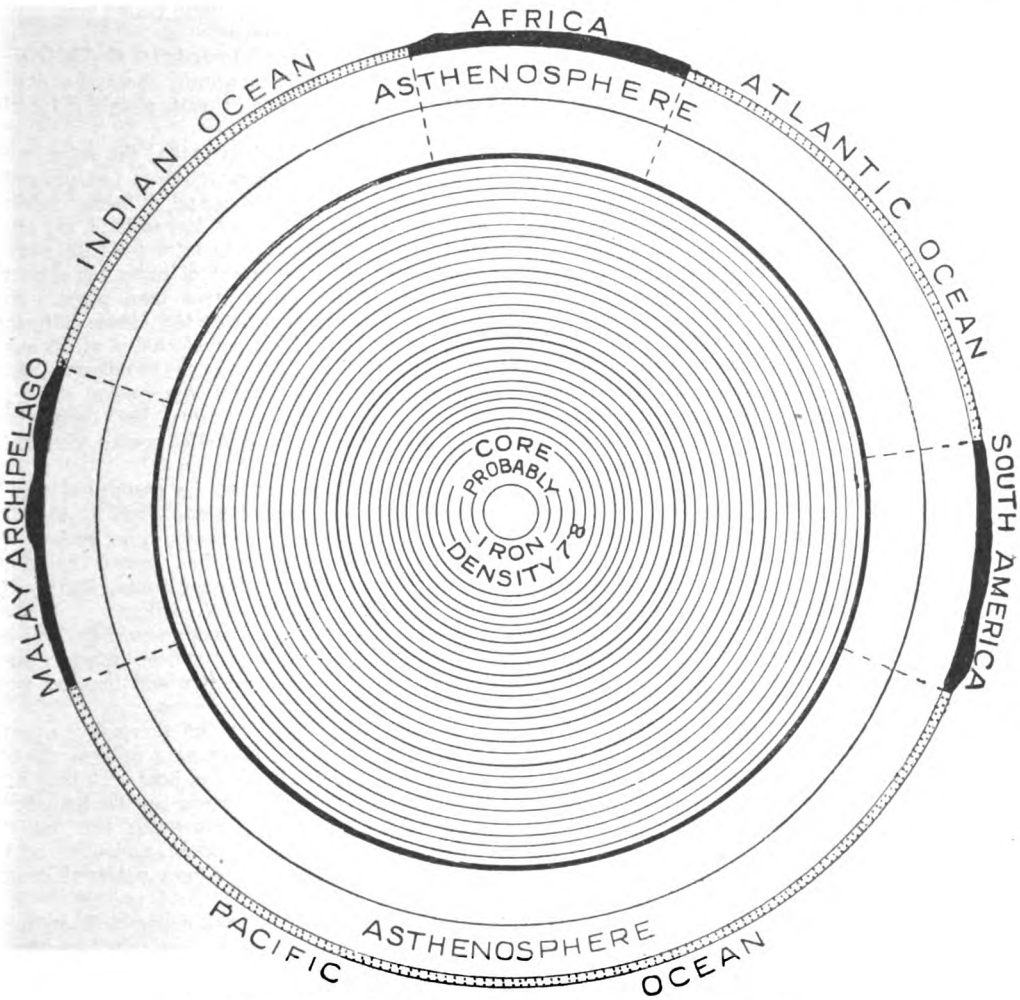


FIG. 53.—EQUATORIAL SECTION THROUGH THE EARTH.

The *Lithosphere* is 75 miles thick and has a density of 2·6 to 3·4. (Continental segments are shown black; oceanic segments dotted.) The *Stony Zone*, between the Lithosphere and the Core (unshaded) has an average density of 3·4, including the *Asthenosphere*, by means of movements in which the Lithosphere is maintained in isostatic equilibrium; the *Core*, probably made up largely of iron, has an average density of 7·8, and a radius of 3,000 miles.

arrive at any station more than 700 miles from the source at two different times.

At a point distant a quarter of the earth's circumference from the point of origin, the compressional wave arrives in 15 minutes, having travelled at more than 6 miles a second, while the distortional wave is not recorded till ten minutes later, for it has travelled 3¾ miles a second.

The surface waves travel even more slowly, the can only be described as *solid*, for fluids are incapable of transmitting distortional stresses.

By earthquake waves the interior of the earth is penetrated and explored, and the results recorded by seismometers, just as the universe is explored by the telescope and spectroscope, and even more appropriately, as the atom is explored by the Becquerel rays which penetrate it.

From the velocities of earthquake waves at

different depths, the physical character of different parts of the earth's interior can be investigated.

So far this work is only in its infancy, but it has definitely proved that the rocky crust of the earth differs from the denser material within, and that the latter itself can be divided into at least two well-marked zones.

Moreover, the surface of separation between the two internal zones may be at a far greater depth under the continents (2,000 miles) than under the oceans (1,000 miles), thus suggesting that the salient features of the land masses and ocean basins are related to physical differences extending deeply into the globe.

Other lines of evidence besides the transmission of earthquake waves also prove that the earth is very rigid. The heights of the fortnightly ocean tides, and of the elastic tides which swing the solid rocks up and down twice a day, and the wandering of the poles all indicate that the earth is more rigid than a corresponding globe of steel.

It has been found that the tides in the solid crust point to the existence at a depth of between 75 and 450 miles of a weak and plastic zone, 375 miles thick beneath the stronger lithosphere, which is here considered to extend downwards about 75 miles.

This plastic zone, or zone of weakness, lies between the lithosphere and the centrosphere, and on account of its most characteristic feature—weakness—it has been called by Barrell the *Asthenosphere.*

The distinction between the terms *plastic* and *viscous* should be carefully noted. A fluid may be viscous for it is deformed by any stress, however small. A solid is plastic only after a certain limit of stress has been exceeded. Below that limit it is elastic and not subject to permanent deformation.

Slow and Massive Movements. — In striking contrast to the intense vibrations of the sudden earthquake, are those great world-wide movements which are responsible for the rise and fall of continental platforms and ocean basins and for the slow wrinkling and thrusting displayed in mountain systems.

These movements are classified into two main types: *Epeirogenic,* upward or downward movements which affect wide areas of the surface, sometimes called continent-building movements; and *Orogenic,* folding movements which pucker up the strata along well-marked lines, sometimes called mountain-building movements.

In the former case (epeirogenic) the dominant direction of movement is vertical. If upward the strata concerned are stretched and fissured; if downward the strata are squeezed, fissures are closed and local folding and thrusting may thus be caused.

In the case of orogenic movements the forces are predominantly horizontal, squeezing certain bands of strata into a smaller space and thus producing linear folding, thrusting and uplift. The uplift in turn tends to produce local stretching and fissuring. It is therefore clear that vertical movements lead to horizontal stresses, and horizontal or tangential movements lead to vertical stresses.

The main factors concerned in the control of great earth movements are loss of heat, and probably also contraction under gravity. The next most important factor lies in the wearing down and lightening of the continents by denudation, and the building up and weighting of the surrounding sea floor by deposition. Another factor lies in the rotation of the earth from west to east, and its effect upon rising and falling segments of the lithosphere.

Contraction and Mountain Building.—The rocks in folded mountain chains have been folded and sometimes overthrust, plainly indicating lateral compression.

The simplest explanation is that the outer crust, which is practically unshrinkable, has crumpled up as it sank on the cooling and shrinking internal mass of the globe—just as the skin of an apple wrinkles over the dried and contracted fruit within.

For every mile of descent of the crust a lateral shortening of 6·3 miles must take place. Now the shortening represented by the Alps is estimated at 74 miles, that of the Appalachians at 46 miles, and that of the Laramide range at 25 miles. Taking the whole world the lateral compression since the beginning of geological history has been about 200 miles, pointing to a radial contraction of 32 miles.

This is far too great to be accounted for by cooling from the surface alone—but it might be explained if the deep interior has cooled and contracted, so that heat has passed from the central region into the higher zones, leaving the outer crust subject to outside cooling.

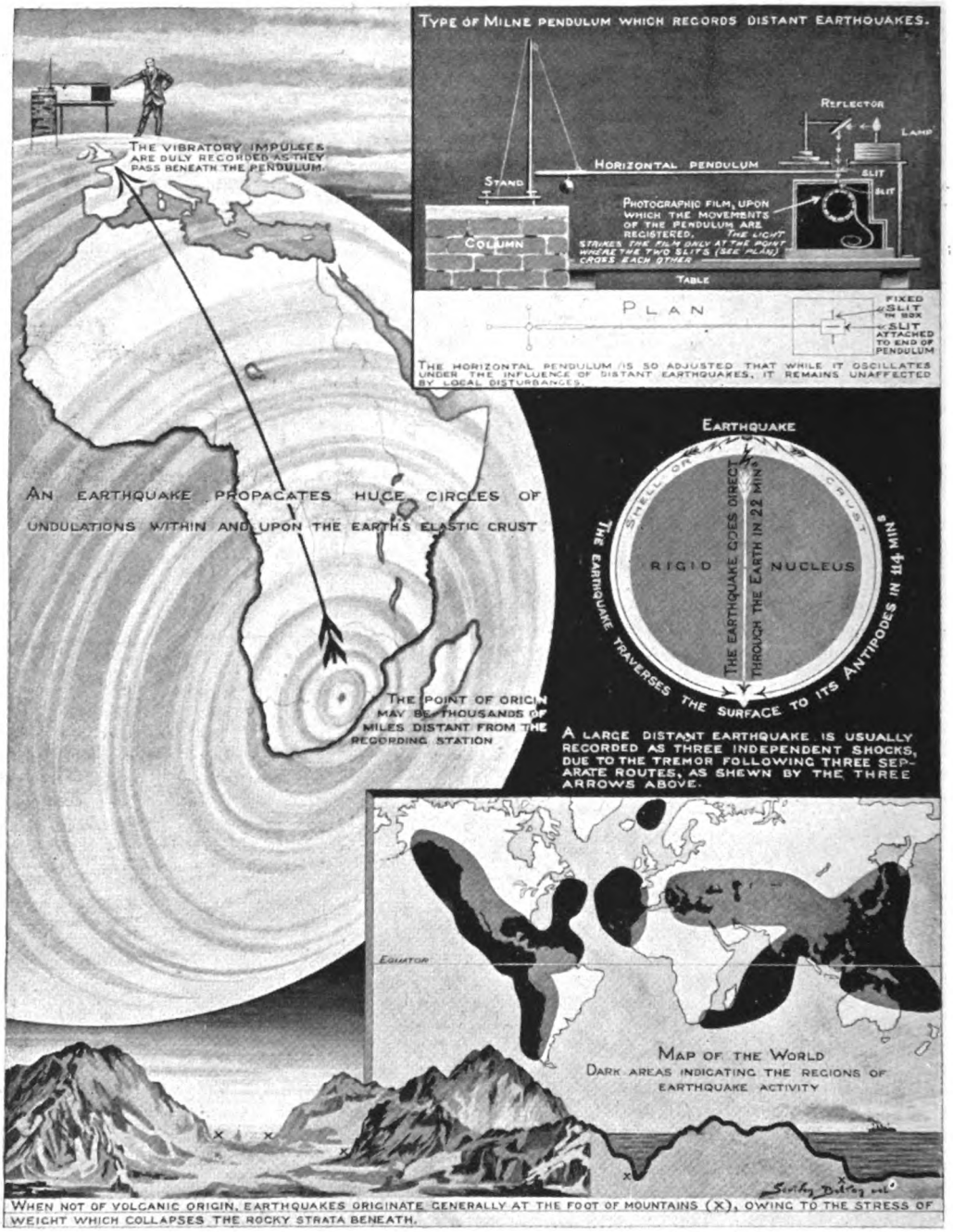
In this way the heated zones would expand and yet be forced to shrink on the deep interior, and a doubly powerful contraction would become available for buckling the outer crust.

It is doubtful whether the thermal properties of the interior would allow this process to take place simply by conduction of heat. It has, however, undoubtedly taken place by the transfer of magmas from deep levels towards the exterior, where they consolidate as rocks, and thus add to internal radial contraction and external crumbling.

The earth may also have contracted owing to compression under gravity—that is to say, in the deep interior chemical and physical changes may have taken place under high pressure whereby denser forms of matter were produced. Probably both sources of contraction have played an important part.

The oldest rocks of the earth's crust are everywhere folded and contorted by lateral pressure, but as the early earth segments grew stronger, so the lines of compression came to be located along areas of weakness.

As we shall see, the weakest and most mobile parts of the earth's crust are situated along the borders of ocean basin and continental platform. The weakness is increased by the fact that fresh sediments are deposited on the sinking floor of the seas around the lands, and still more by the fact that those sediments contain radium which gives out heat. Further, the fresh sediments are heated as they are buried.



Drawn by Scriven Bolton, F.R.A.S.

SHOWING HOW EARTHQUAKES ARE RECORDED IN ENGLAND

wherever they occur. An earthquake sends out waves of motion in a way similar to that in which a stone when thrown into a pool produces circular ripples. The vibratory impulses are duly recorded as they pass under a pendulum (*vide* above), and, since an earthquake is usually recorded as three independent shocks, due to the tremor following three different routes (as shown in the drawing), it is possible, by comparing the differences in speed of the tremors, to calculate the distance of the earthquake from the recording instrument.

Thus the fresh sediments are heated as they are buried, partly because they are lowered slowly into the more heated interior, and partly because of their own content of radium.

Being fresh, and hot, and on lines already subject to movement, it is easy to understand that the compressive forces will attack them before other parts of the crust would yield, and thus we find great folded mountain ranges raised up on the borders of the continents where previously sedimentation had progressed for many ages.

Isostasy.—Owing to denudation and deposition the continents are worn down and the surrounding sea floor is built up. Why, then, is the earth not reduced to one uniform level? The explanation is that the continents rise as they are lightened by the removal of débris, and the ocean floors sink under the loads deposited around them. Moreover, gravity determinations, by the plumb-line and pendulum, have shown that the rocks of continental and mountain elevations are actually lighter than those beneath the oceans.

This is indicated to some extent by the rocks themselves. Oceanic islands are mainly basaltic, in respect of the lavas which rise from below, whereas the continents are mainly granitic.

The view has thus arisen that the continental elevations and the oceanic depressions are maintained because they are balanced on an underlying plastic zone. Each column of the lithosphere

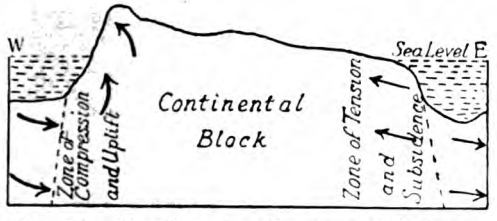


Fig. 54.—Showing the direction of tidal and centrifugal forces set up by the earth's rotation.

is approximately equal in weight to the adjoining columns, and the lighter rise high above the sea, while the heavier sink beneath it. This balance of different areas relating height and density has been called isostasy.

The lateral transfer of weight at the surface due to erosion and sedimentation, implies a corresponding counter movement within the earth below.

This movement probably occurs in the plastic zone of the Asthenosphere, below the 75 miles of the lithosphere. Thus light matter is squeezed out from under the oceans towards the continents, and the latter maintain their lightness and elevation; whereas the rocks far below the oceans become heavier by the elimination of lighter matter and maintain their tendency to sink.

The Influence of Rotation and Tidal Forces on Elevation and Depression.—It is a fairly general rule that the western sides of continents and large islands are higher than the eastern, that fjords are especially characteristic of western coasts, and that volcanoes frequently occur on the eastern side of depressed areas.

All these facts can be explained to some extent by the rotation of the earth from west to east. We have already seen that the continents tend to rise. As they do so they constantly pass into levels where the rotational velocity from west to east and the tidal attraction are greater than those at the lower levels from which they have risen.

Consequently they tend to lag behind and press back towards the west. The sinking ocean floor, on the contrary, reaches levels where the rotation is less rapid and tidal attraction less powerful, and they therefore press forward towards the east.

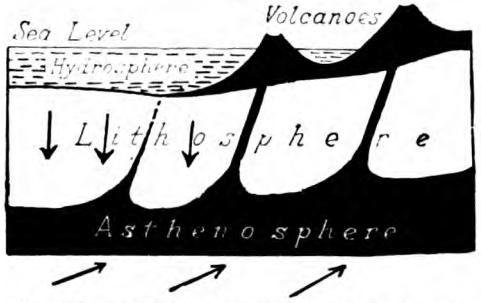


Fig. 55. — Explaining diagrammatically the formation of volcanoes on the east of depressed and sunken areas.

The same reasoning applies to the movements deep down in the Asthenosphere. It will therefore be clear that, on the west, continent and ocean press together. The continent tends to be thrust to the west, and upraised still further by the passage of light plastic material from oceanic to continental areas far below.

On the east, however, the two segments drag apart; the continent is left unsupported and subsidences occur. The subsided areas on the west of the Pacific prove the reality of the effect.

On the west of continents the gentle upheaval leads to stretching and cracking, and fjords seem to be the representatives of such cracks, opened up and widened by the action of rivers and glaciers.

We have seen that the movements of deep-seated plastic material are from under subsided regions towards the east. Probably igneous activity begins in the Asthenosphere, but even in the lithosphere the same laws apply to moving masses of lava. Their tendency is to flow to the east and to turn upwards as they reach a rising continental or island segment. Here on the *west* of the elevated region are fissures and cracks through which the lavas ultimately find their way, escaping in volcanic eruptions.

In the following lesson we shall see that many of the volcanoes of the earth are just where we expect to find them, on the east of depressed and sunken areas. It must not be supposed, however, that the above account is complete. Thermal stresses, due to different rates of cooling of continental and denuded areas, and oceanic and sedimental areas are also important factors in modifying the results achieved. A. H.

METEOROLOGY.—IV

It has already been shown that for the production of rain masses of air must be cooled down to the dew-point. The air may be cooled in several ways, by far the most usual process being the ascent of air into higher regions of the atmosphere. On reaching these higher regions a mass of air expands because the pressure is diminished.

Now when any gas expands, heat is absorbed in the process; consequently the temperature falls and, if the drop in temperature be sufficient, condensation takes place. The fall in temperature due to expansion is called *dynamical cooling*, and is of great importance in the study of meteorology.

Rainfall

The ascent of air into the higher regions may be brought about in different ways. Mountains deflect winds upwards and thus lead to dynamical cooling; consequently mountainous regions generally have a heavier rainfall than lower regions, other things remaining the same. The student should compare a rainfall map of the British Isles with an orographical map of the same region, when he will notice the striking connection between rainfall and the distribution of mountains and hills. (Refer to Geography, Vol. II., pp. 226–229.) In some regions huge masses of air are caused to ascend by entirely different circumstances. Relatively cool air blowing inland from the sea may pass over large areas of heated land. Consequently the temperature of such air rises and the heated air then ascends to the upper regions. This is precisely what happens in the Amazon Basin, a region devoid of mountains yet one of the wettest districts in the world.

But air may be cooled without ascending at all. At night time the land loses heat by radiation, consequently the lower layers of air touching the earth become cooled and condensation may lead to the formation of low clouds, particularly the variety known as stratus. Yet another mode of cooling occurs when a mass of warmer air mingles with another mass of cooler air, a state of things which frequently happens at an elevation of one or two miles.

It is hardly necessary to say that the study of rainfall is of great value to the agriculturist. For many years rainfall statistics have been obtained particularly by the British Rainfall Organisation, which is affiliated with the Meteorological Office. A very large number of private individuals is supplying details of rainfall to this organisation, and the work of new observers, particularly those situated in some rural districts would be very helpful. Conditions and rules for rainfall observers may be obtained from the Directors of the Organisation, 62 Camden Square, London, N.W.1.

Instruments used for measuring rainfall are known as rain gauges. There are several patterns of these instruments, but for the sake of uniformity the Meteorological Office recognises the Snowdon Gauge, and a form of apparatus generally known as the Meteorological Office Gauge. The more commonly used of these is the Snowdon pattern.

The Snowdon Gauge

This apparatus consists of a bottle in the neck of which is inserted a funnel. The bottle and the funnel are placed inside a cylindrical can, while all of these parts are contained in an outer metallic vessel the diameter of which is five inches. The top of the funnel should be four inches below the rim of the outer vessel. It is of great importance that the top of the outer vessel should be kept in a horizontal plane, in order to catch rain that may blow in from any direction. Considerable care must be exercised in the erection of a gauge in order that this and other standard conditions may be observed. The instrument must be placed in a cylindrical hole in the ground of such depth that the rim of the outer vessel is exactly one foot above the surface of the ground. The hole should be lined with concrete and the gauge should fit quite tightly.

The site for a rain gauge must be chosen with particular care. The ground should be quite level and bear short grass, while the situation should be perfectly open with no trees or buildings to obstruct rain in its passage to the gauge. Further, flowers and vegetables must not be allowed to grow in close proximity. In very elevated country the instrument must not be placed in a too exposed position, in order that the correct rainfall may be registered and not an improper amount swept in by gusts of wind.

With each instrument is supplied a graduated glass jar called the Camden Measuring Glass. Each morning precisely at nine o'clock the rain collected during the previous twenty-four hours is poured into the measuring glass, which indicates the amount in hundredths of an inch. Should there be more rain than is required to fill the glass to the upper mark, the estimation

is performed by measuring the amount in instalments and adding them together. The glass is constructed to hold half an inch of rain when the water is at the level of the uppermost mark.

The bottle of the instrument must be sufficiently large to hold at least four inches of rain, since exceptionally heavy showers resulting in a fall of several inches have been known to occur even at localities which usually have a very small rainfall. Should water overflow into the inner can, such water should be measured and added to that already collected in the bottle.

The best instruments are made of copper, but the cheaper ones are made of galvanised iron and painted. The Meteorological Office pattern is very similar to the Snowdon Gauge, but the diameter is eight inches. Sometimes the fall of rain is estimated in millimeters, but in Britain it is usual to express the result in fractions of an inch. In entering the results on weather reports, figures representing hundredths of an inch should be used. Thus half an inch is written ·50 and one-hundredth of an inch is entered as ·01.

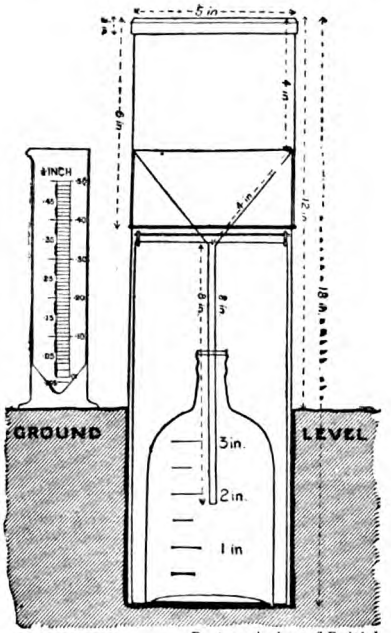
Rate of Rainfall

If water falls in the form of snow the estimation is not such an easy matter. In a Snowdon Gauge the position of the funnel four inches below the top of the outer can ensures that snowflakes, once having entered the instrument, are not blown out. To measure the amount of snow, which must be expressed as rain, the funnel and bottle are gently warmed so that the snow melts, and the water is measured in the glass.

One foot of snow is roughly equivalent to one inch of rain, the greater volume of snow being due to there being large quantities of air intimately mixed with the snowflakes.

Hail is in the nature of more compact ice. There are two distinct types, *soft hail*, composed of tightly packed snow particles, essentially a phenomenon of winter, and *true hail*, formed more often in summer during thunderstorms. True hail is usually composed of layers of ice alternating with compact snow, and is considered to have originated from ordinary soft hail that has been ascending and descending in the clouds before ultimately reaching the earth. Such true hailstones frequently weigh several ounces, and are responsible for much damage. Hailstones as large as hens' eggs have fallen in the British Isles.

The student may obtain some idea of one-hundredth of an inch of rain from the fact that such a quantity is equivalent to more than one ton of rain per acre. If one-hundredth of an inch of rain falls in twenty-four hours we consider that period to be a rainy day; and should there be fourteen such days in succession we call the period a spell of wet weather. The rain gauges described above merely measure the amount



By permission of British Rainfall Association.

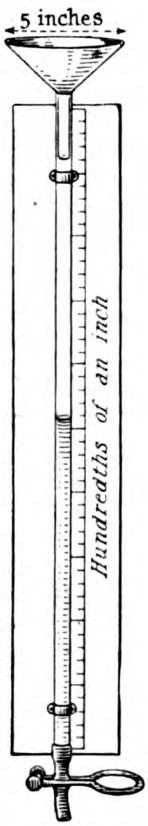
Figure showing diagrammatically the construction and working of a Snowdon Rain Gauge.

of rain which falls in twenty-four hours, but tell us nothing of the rate at which the rain fell at any particular time during that twenty-four hours. If we wish to know the periods of the day at which rain was falling, and the rate at which it collected, some sort of apparatus must be employed that will do for us in connection with rainfall what sunshine recorders do with regard to sunshine. In other words we must use a self-recording *hyetograph*—an instrument that draws a line on paper, showing the exact times at which rain fell, and the rate at which it fell.

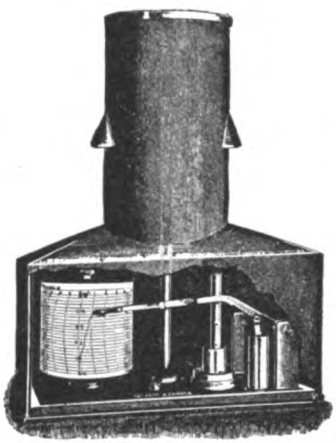
There are several patterns of such instruments, but the best known consists of a funnel inserted in a cylindrical vessel some inches from the top as in the Snowdon Gauge. Rain falling into the funnel descends into a lower chamber containing a float. As the rain collects in this chamber the float rises, and imparts corresponding motion to

a lever bearing a pen at the farther end. Thus, upward movements of the float result in an upward line being traced on paper, which is mounted on a cylindrical drum rotated by clockwork, as in the case of the barograph.

During a very heavy shower water collects very rapidly in the chamber of the hyetograph, the float rises quickly and the pen traces a highly inclined line on the paper; thus by noting the steepness or otherwise of the lines, the rate at which the rain fell during the day can be noted, and since the paper has marks which represent the hours of the day, the precise time at which showers occurred can also be noted. Should the chamber of the hyetograph become full a siphon arrangement quickly empties the chamber and the process is repeated, the pen commencing again at the bottom edge of the paper.



A gauge, such as shown above, for studying rate of rainfall can be easily constructed and will prove quite reliable.



By permission of Messrs. Negretti & Zambra.

A hyetograph — an instrument which records the exact times at which rain falls and the rate of fall.

The reader may construct a simple apparatus which will enable him to study the rate of rainfall. A long glass tube is attached to a board placed vertically. The lower end of the tube is closed and a glass funnel is connected with the upper end.

If standard conditions are to be observed, the funnel should be five inches in diameter, and the tube must be graduated with marks that represent hundredths of an inch of water falling on the area of the funnel. This graduation can be performed by pouring water from a Camden measuring glass into the tube and by placing the corresponding marks on the wood one side of the tube. This simple arrangement easily indicates the rate of rainfall, and if the tube be sufficiently long a whole day's rain may be noted.

It will help the observer to note his results if a small wooden float be placed inside the tube, and it would also be an advantage if the lower end of the tube were closed by means of india-rubber tubing and a pinch-clip.

The actual production of rain is intimately related to the relative *humidity*, i.e. to the amount of water vapour present in the air, compared with the amount the same volume of air could hold if saturated at the same temperature. If the air at a given temperature holds, say, 50 per cent. of the water vapour it could hold at that temperature, considerable cooling must take place before the saturation point is reached and clouds begin to form. The likelihood of rain is not so much a question of the total amount of water vapour present (absolute humidity), but depends upon whether the air is near the saturation point. Instruments used to show us whether or not the air is nearly saturated are called *hygrometers* (*See* Vol. II., pp. 69, 70). There are hygrometers constructed in such a way that the relative humidity and dew-point can be read directly from them, and these are most useful to persons engaged in horticultural work.

Glaisher's Table

But such horticultural hygrometers are expensive, and equally good results can be obtained by the use of tables used in connection with the dry and the wet bulb thermometers mounted in the Stevenson screen.

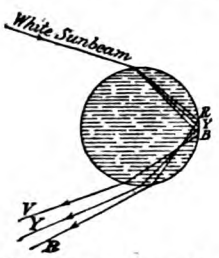
Precisely at nine o'clock each morning the observer notes the readings indicated by the dry and wet bulb thermometers. When the air is saturated with water vapour the two thermometers give the same readings—a state of things which may indicate that wet weather is about to occur. But usually the two thermometers give different readings and generally the greater the difference, the less the likelihood of rain since the air is far from saturated.

For exact reading the actual *dew-point*, or saturation temperature, may be calculated from Glaisher's Table as follows :—

PORTION OF THE TABLE OF GLAISHER'S FACTORS.

Reading of Dry bulb Thermometer	*Factor*	*Reading of Dry bulb Thermometer*	*Factor*	*Reading of Dry bulb Thermometer*	*Factor*
30	4·15	43	2·20	56	1·94
31	3·70	44	2·18	57	1·92
32	3·32	45	2·16	58	1·90
33	3·01	46	2·14	59	1·89
34	2·77	47	2·12	60	1·88
35	2·60	48	2·10	61	1·87
36	2·50	49	2·08	62	1·86
37	2·42	50	2·06	63	1·85
38	2·36	51	2·04	64	1·83
39	2·32	52	2·02	65	1·82
40	2·29	53	2·00	66	1·81
41	2·26	54	1·98	67	1·80
42	2·23	55	1·96	68	1·79

Note the reading of the dry bulb thermometer and suppose it to be 50°, and further suppose the wet bulb instrument to record a reading of 40°. Obtain from the table the factor of 50°, and multiply the difference between 50 and 40 by this factor. Thus, difference 10 × factor 2·06 = 20·6. Deduct 20·6 from 50 and the result 29·4 gives the dew-point. This particular example shows that the dew-point is very low when the two thermometers indicate very different temperatures.



Showing how a raindrop refracts, reflects and disperses sunlight.

Further, such a case as this indicates the likelihood of frost at night, since the dew-point is below the temperature at which water freezes. Although the readings of the two thermometers are taken at 9 a.m., an occasional glance at these instruments during the day often enables the observer to gain information about likely changes in the weather. Should the wet bulb thermometer rise, considerably warmer and wetter weather may occur within a short time. If the dew-point be determined by an evening observation the lowest temperatures possible during the night may be determined, and if this should be below 32° F. a frost may be experienced. There are *self-registering hygrographs* which make a record on paper of changes in humidity. Some of these instruments are worked by means of dry and wet bulb thermometers, others by the expansion or contraction of hygrometric substances such as human hair and catgut.

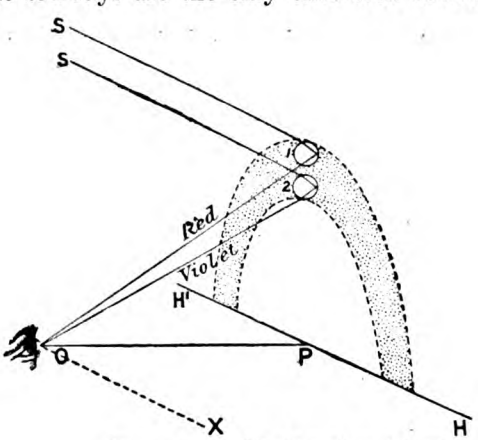
A person is able to see a rainbow when the sun is behind him and a mass of falling raindrops is situated in front of him.

Each drop of rain acts as if it were a glass prism dispersing the ray of sunlight which enters it, so that the simple white light which enters any drop is split up into the colours of the spectrum as seen by the observer. The rainbow forms part of a circle, its size depending upon the position of the sun.

Colours of the Rainbow

The sun's position is expressed in degrees, or angular measurement, commencing at the horizon. If the sun's altitude exceeds 42° no rainbow can be seen, and as in these latitudes the sun's elevation is often greater than 42°, at midday during summer, no rainbow is seen in our country about the middle of the day in the summer months.

The drops in the higher and outer portions of the bow disperse—that is, break up—the white light into colours, just the same as those in the lower portion of the bow. But owing to the position of the observer's eye, the red rays are the only ones seen coming



Diagrams on this page from Thornton's "Advanced Physiography," by permission of Messrs. Longmans, Green & Co.

Diagrammatic representation of a rainbow. O = the observer; S S are rays of sunlight which are being dispersed by 1 and 2, two of the raindrops; H′ H = horizon; O P = horizontal line. X O P must be less than 42°.

from the rain at the top and border of the bow, the other colours being sent to positions above the eye. Similarly the drops in the lower and inner portions of the arc send coloured rays, but in this case only the violet rays are seen by the eye, the other colours being too low for that position of the eye. The observer sees the other colours of the spectrum, orange, yellow, etc., because raindrops between the extreme edges of the bow send these rays to the eye. L. M. P.

Continued from page 102.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A. [Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

GERMAN.—XXXIII

Prepositions governing the accusative and the dative (*continued*).

Neben denotes nearness without contact.

(*a*) Of place: er ſitzt neben ihr; *he is sitting beside her;* er ſetzt ſich neben mich, *he sits down beside me;* neben einander gehen, *to walk abreast.*

(*b*) Metaphorically it means besides or in addition to: du ſollſt keine anderen Götter neben mir haben, *thou shalt have no other gods before me.*

Über means over or above. It may denote contact or not.

(*a*) Of place, with the dative denoting:

1. Rest above: die Wolke ſchwebt über dem Berge, *the cloud floats above the mountain;* die Lampe hängt über dem Tiſch, *the lamp hangs over the table.*

2. Rest on the other side of: die Stadt liegt über der Grenze, *the town lies beyond the frontier.*

With the accusative denoting:

1. Motion to a place above: er hängt die Lampe über den Tiſch, *he hangs the lamp over the table.*

2. Motion over a thing so as to cross it or pass over it: über die Straße laufen, *to run across the street;* über Hannover nach Berlin reiſen, *to travel to Berlin via Hanover;* wir ſind über den Fluß, *we are across the river* (the accusative is used here because a verb of motion is understood).

3. Motion so as to cover a thing: eine Decke über das Bett breiten, *to spread a cover over the bed;* er reiſte über die ganze Welt, *he travelled over the whole world.*

(*b*) Of time, with an accusative to denote duration: über Nacht bleiben, *to stay over the night;* and frequently in this sense it is placed after the noun: ich blieb den Winter über im Süden, *I remained in the south over the winter.*

Meaning after a certain time: heute über acht Tage, *this day week;* über die Zeit arbeiten, *to work overtime;* über die Zeit ausbleiben, *to be overdue;* über fünf Minuten, *more than five minutes.*

(*c*) Metaphorical uses: bis über die Ohren, *over head and ears;* das geht über meinen Verſtand, *that passes my comprehension;* über die Schnur hauen, *to kick over the traces;* über's Ohr hauen, *to cheat;* über alles, *beyond everything.*

With the idea of being engaged on a thing: über den Büchern einſchlafen, *to fall asleep over your books;* über der Mahlzeit von etwas ſprechen, *to speak of a thing at a meal,* but über die Mahlzeit ſprechen, *to speak about the meal.*

(*d*) It is used with many verbs expressing emotion or some mental process: ſich über eine Sache freuen, *to rejoice over a thing;* über etwas ſprechen, ſchreiben, *to speak, write, about a thing.*

(*e*) In expressions denoting superiority: Herr werden über ſeine Feinde, *to gain the mastery over one's enemies.*

(*f*) To denote quick succession or quantity: Briefe über Briefe, *letter upon letter;* Schulden über Schulden, *debt on debt.*

Unter denotes both under and among.

(*a*) Meaning under: unter einem Baum ſitzen, *to sit under a tree;* unter den Tiſch kriechen, *to creep under the table.*

(*b*) Metaphorical expressions: unter Karl dem Großen, *under Charles the Great;* unter der Regierung Wilhelms des Erſten, *in the reign of William the First;* unter dem Siegel der Verſchwiegenheit, *under the seal of secrecy;* unter meinem Schutz, *under my protection.*

(*c*) Meaning below: unter zehn Jahre alt, *below ten years of age;* unter aller Kritik, *beneath criticism.*

(*d*) Meaning among: unter den Zuſchauern, *among the spectators;* unter die Soldaten gehen, *to become a soldier* (go among the soldiers); unter uns, *between you and me;* ein Rieſe unter den Zwergen, *a giant among dwarfs;* Waſſer unter dem Wein, *water in the wine;* unter zwei Parteien Frieden ſtiften, *to make peace between two parties;* unter lautem Gelächter, *accompanied by loud laughter.*

Vor was originally the same as für, and is chiefly used with regard to place, though it has many derived meanings.

(*a*) Of place, meaning in front of: er ſtand vor mir, *he stood before, in front of me;* er ſetzte es vor mich hin, *he put it down in front of me;* vor uns, *ahead of us.*

(*b*) Of time: vor zehn Uhr, *before ten o'clock;* er war vor zwei Jahren hier, *he was here two years ago;* er kann vor drei Tagen nicht zurück ſein, *he cannot be back before three days;* vor kurzem, *a short time ago.*

(*c*) In metaphorical expressions, meaning in the presence of: vor dem Richter erſcheinen, *to appear before the judge;* vor Gericht laden, *to summon before the court;* vor Anker liegen, *to lie at anchor.*

(*d*) To denote the cause: vor Gram umkommen, *to die of grief;* er ſieht den Wald vor Bäumen nicht, *he cannot see the wood for the trees;* vor Freude lachen, *to laugh with joy.*

Zwiſchen, like English between, properly only refers to two individuals, but it is commonly used in the sense of among.

(*a*) Of place: zwiſchen den beiden Bäumen ſitzen, *to sit between the two trees.*

(*b*) Of time: zwiſchen heute und morgen, *between to-day and to-morrow.*

(*c*) In metaphorical expressions: Streit zwiſchen den Brüdern, *a quarrel among the brothers.*

Conjunctions. — Conjunctions are conveniently divided into two classes:

1. Co-ordinative Conjunctions, which join sentences of the same rank and kind.

2. Subordinative Conjunctions, which serve to introduce sentences which are dependent on some word or words in another sentence.

Class 1 may again be divided into:—

(*a*) General Connectives meaning *and, but, for, or* and *either.*

Their German equivalents are: und, *and,* aber, allein, ſondern, *but,* denn, *for,* entweder, *either,* and oder, *or.*

ſondern is more strongly adversative than aber, and is used after a negative.

Compound expressions of this class are nicht nur . . . ſondern auch, *not only . . . but also;* ſowohl . . . als is very nearly equivalent to *both . . . and.*

(*b*) Adverbial Conjunctions; these were originally adverbs modifying the verb of the clause following them. When placed first in the sentence they cause an inversion of the normal order of words, the verb being placed before its subject.

They fall into four groups:—

Copulative or connective. Such are auch, *moreover,* außerdem, *besides,* dann, *then,* ferner, *further;* erſtens, zweitens, u.ſ.w., *firstly, secondly,* etc.; weder . . . noch, *neither . . . nor,* bald . . . bald, *now . . . now,* teils . . . teils, *partly . . . partly,* gleichfalls, *likewise,* and so on.

Adversative. These are akin to *but;* such are: doch, jedoch, dennoch, *yet, though,* gleichwohl, deſſenungeachtet, nichtsdeſtoweniger, *nevertheless,* dagegen, *on the contrary,* indeſſen, *however,* vielleicht, *perhaps,* zwar, *to be sure,* and so on.

Causative. These are akin to *for;* such are: daher, deswegen, deshalb, *therefore, also,* folglich, *consequently,* and so on.

Adverbs of Place and Time. Such are: vorher, *previously,* darauf, *thereupon,* unterdeſſen, *meanwhile.*

VOCABULARY

entſcheidend, *decisive.*
Sacrament', s.m.2., *sacrament.*
herum'ſehen, s., *look round.*
ſich wenden, w., *to turn.*
ziehen, s., *to shrug.*
Zahn, s.m.2, *tooth.*
knien, w., *to kneel.*
ſich an'ſchicken, w., *prepare, set about.*
Oelung, w.f., *anointing.*
Zeichen, s.n.1, *sign.*
ziehen, s., *to draw.*
Streich, s.m.2, *stroke.*
Tuch, s.n.3, *cloth.*
tödtlich, *fatal, death-dealing.*
fürchterlich, *fearful.*
Herzog, s.m.2, *duke.*
Fenſter, s.n.1, *window.*
heran'nahen, *approach,* w.
empfangen, s, *receive.*
erfolgen, w., *happen, occur.*
Begnadigung, w.f., *pardon.*
beißen, s., *bite.*
Nachtrock, s.m.2, *bed-gown.*
Kiſſen, s.n.1, *cushion.*
Crucifix, s.n.2, *crucifix.*
küſſen, w., *kiss.*
Graf, w.m., *count, earl.*
verlaſſen, s., *leave.*
Mütze, w.f., *cap.*
Leichnam, s.m.2, *corpse.*
ſich drängen, w., *crowd.*
unterbre'chen, s., *interrupt.*
Stille, *calm, silence.* f.
Hinrichtung, w.f., *execution.*
wiſchen, w., *wipe.*

Exercise 73 (*continued from* 71)

Wie der entſcheidende Augenblick herannahte, wo[1] er das letzte Sacrament empfangen ſollte, wie er harrend herumſah und noch immer[2] nichts erfolgte, ſo[3] wandte er ſich an Julian Romero, und fragte ihn noch einmal, ob keine Begnadigung für ihn zu hoffen[4] ſei. Julian Romero zog die Schultern, ſah zur Erde und ſchwieg.

Da biß er die Zähne[5] zuſammen, warf ſeinen[6] Mantel und Nachtrock nieder, kniete auf das[7] Kiſſen und ſchickte ſich zum letzten Gebet an. Der Biſchof ließ ihn das Crucifix küſſen und gab ihm die letzte Oelung,[8] worauf ihm der Graf ein Zeichen gab, ihn zu verlaſſen. Er zog alsdann[9] eine ſeidene Mütze über die Augen und erwartete den Streich. — Ueber den Leichnam und das fließende Blut wurde ſogleich ein ſchwarzes Tuch geworfen.

Ganz Brüſſel,[10] das ſich um das Schaffot drängte, fühlte[11] den tödtlichen Streich mit. Laute Thränen unterbrachen die fürchterlichſte Stille. Der Herzog, der der Hinrichtung aus einem Fenſter[12] zuſah, wiſchte ſich die Augen.

Notes:—

The student will notice that two words beginning with a modified vowel, namely Ölung and Über, have an e placed after the vowel; this is because until fairly recent times the Germans never put a modification sign over a

capital letter, but indicated the modification by placing an e after the capital. (1) wo is used for time as well as place. (2) noch immer, *still*. (3) Omit ſo. (4) hoffen, active infinitive with passive meaning. (5) die Zähne zuſammenbeißen, *to clench one's teeth*. (6) ſeinen, this need not be repeated before Nachtrock, because Mantel and Nachtrock are the same gender and the same case. (7) auf das Kiſſen, the accusative means that he knelt down on the cushion; if the dative had been used it would have meant he was kneeling on the cushion. (8) die letzte Oelung, *extreme unction*. (9) alsdann is practically the same as the simple word dann. (10) ganz Brüſſel, *the whole of Brussels*. (11) fühlte . . . mit, mitfühlen, literally means to feel with a person, but in this case it is best translated by the simple verb *feel*. (12) aus einem Fenſter, *from out of a window*.

VOCABULARY

take, verſtehen, s.
sweet, Süßigkeit, w.f.
vast, ſehr groß.
clever, geſcheit.
why, zum Beiſpiel.
physician, Arzt, s.m.2.
fiction, Dichtung, w.f.
chancellor, Kanzler, s.m.1.
notorious, bekannt.
kind, lieb.
whist, Whiſtſpiel, s.n.2.
doubt, bezweifeln, w.
eat, eſſen, s.
sick, übel.
surprise, überraſchen, w. insep.
rightful, rechtmäßig.
waterman, Waſſerträger, s.m.1.
beggarly, armſelig, zerlumpt.
star, Stern, s.m.2.
various, verſchieden.
clasp, drücken, w.
prove oneself to be, ſich erweiſen als.
character, Perſon, w.f.
pumps, Ballſchuhe, s.m.2, pl.
century, Jahrhundert, s. n.2.
allegory, Gleichniß, s.n.2.
literary, litterariſch.
number, Anzahl, w.f.
hard-headed, verſtändig.
learned, gelehrt.
exquisite, köſtlich.
bishop, Biſchof, s.m.2.
mathematician, Mathematiker, s.m.1.
sweet, lieblich.
tender, zärtlich.
naughty, unartig.
glut, Überfülle, w.f.
jelly, Leckerei, w.f.
plot, Verwicklung, w.f.
turn out to be, ſich entpuppen, w., als.
earl, Graf, w.m.
throw off, abwerfen, s. sep.
gabardine, Kittel, s.m.1.
collar of an order, Ordenshalsband, s.n.3.
bosom, Bruſt, s.f.2.
long-lost, längſt verloren.
novelist, Romanſchreiber, s.m.1.
red-heeled, rothackig.
garb, Kleidung, w.f.

Exercise 74 (*continued from* 72)

You take the allegory? Novels are sweets. All people with healthy literary appetites love them—almost all women; a vast number of clever, hard-headed men. Why, one of the most learned of physicians in England said to me only[1] yesterday, "I have just read So-and-So for the second time"[2] (naming[3] one of Jones's exquisite fictions[4]). Judges[5], bishops, chancellors, mathematicians, are notorious novel-readers; as well[6] as young boys and sweet girls, and their kind, tender mothers. Who has not read about Eldon, and[7] how he cried[8] over novels every night when he was not at whist?

As for that lazy, naughty boy at Chur, I doubt[9] whether he will like novels when he is thirty years of age.[10] He is taking too great a glut of them now. He is eating jelly until he will be sick.[11] He will know most plots by the time he is twenty, so that he will never be surprised when the Stranger turns out to be[12] the rightful earl, when the old waterman, throwing[13] off his beggarly gabardine, shows his stars and the collars of his various orders, and clasping[14] Antonia to his bosom, proves himself to be[15] the prince, her long-lost[16] father. He will recognise the novelist's characters, though[17] they appear in red-heeled pumps and ailes-de-pigeon, or[17] the garb of the nineteenth century.

NOTES:—

(1) *Only*, erſt. (2) *For the second time*, zum zweitenmal. (3) *Naming*, say indem er . . . nannte. (4) *Fictions*—the word Dichtung, which we have given in the vocabulary, is mostly used in the narrower sense of poetical writings, but it can be used, as here, to denote all imaginative writings in prose or verse. (5) *Judges . . . novel-readers;* say *it is notorious* (allgemein bekannt) *that judges . . . are novel-readers*. (6) *As well as*, wie auch. (7) *Omit and*. (8) *Cry*, say *shed tears* (Tränen vergießen). (9) bezweifeln is followed by daß and not by ob. (10) *Of age*, say *old*. (11) *Sick*, this is turned impersonally in German, es wird ihm übel, *he grows sick* (it becomes sick to him). (12) *To be*, use als, followed by *the rightful earl* in apposition to er. (13) *Throwing*, use the finite verb *throws*. (14) *Clasping*, say indem er . . . drückt. (15) *To be* (*see* 12). (16) *Long-lost*, say längſt verloren geglaubt (long believed to be lost). (17) *Though . . . or*, ob . . . oder.

Key to Exercise 71

EGMONT'S DEATH

Egmont had at first shown a desire to make a speech from the scaffold to the people. But when the bishop represented to him that either he would not be able to make himself heard (able to be heard), or if he should be heard (if this should happen) he might easily, in view of the present dangerous mood of the people, stir up (give rise to) violence which would only plunge his friends into disaster (ruin), he abandoned this design. For a few moments with noble decorum he walked up and down on the scaffolding, bewailing (and bewailed) that he was not permitted to die a more honourable death for his king and his country. Up to the last moment he had not been able really to persuade himself that the king was in earnest about this pitiless proceeding, and that the matter would be carried further than the terror inspired by the threat of execution (that one would drive it further than the terror of execution).

Key to Exercise 72

Habt ihr jemals zwanzig weißbärtige, weißgekleidete Krieger oder würdige Greiſe geſehen, wenn ſie um das Tor in Jaffa oder Beyrout ſitzen, und dem Erzähler lauſchen der ſeine Wundergeſchichten aus Antar, oder Tauſend und einer Nacht herſagt? Ich war einmal zugegen als ein junger Herr am Tiſche eine Torte von ſich wies, und ſeinem Nachbarn, dem Jüngeren Sohn (mit einem ziemlich albernen Ausdruck) ſagte: „Ich eſſe nie ſüße Speiſen."

„Sie eſſen nicht ſüße Speiſen! und wiſſen Sie warum?" ſagt T.

„Weil ich über Sachen der Art hinweg bin," ſagt der junge Herr.

„Weil Sie ein Schlemmer und ein Trunkenbold ſind!" ruft der Ältere (und Juvenis zuckt ein wenig zuſammen). „Alle Leute, die einen natürlichen, geſunden Appetit haben, lieben ſüße Speiſen; alle Kinder, alle Frauen, alle Völker des Oſtens, deren Geſchmack nicht durch Gefräßigkeit und Zecherei verdorben iſt."

Und ein Teller voll Himbeeren und Sahne verſchwand vor dem Philoſophen.

M. A. L.

RUSSIAN.—XXVI

РУССКАЯ КОРРЕСПОНДЕ́НЦІЯ.

(a) Forms of Bills

Ха́рьковъ. 20 февраля, 1917 г.
Kharkoff.

Ве́ксель на 500 Рубле́й.

Отъ сего́ числа́ чере́зъ три мѣ́сяца по сему́
From this date after three months against this
ве́кселю пови́ненъ я заплати́ть Моско́вскому Купцу
bill I am to pay to the Moscow merchant Simon
Семёну Пётровичу Дружи́нину пятьсо́тъ рубле́й.
Peter Drushinin five hundred roubles.

Ха́рьковскій купе́цъ Михаи́лъ Никола́евичъ
The Kharkoff merchant Michael Nicholas
Гончаро́въ.
Goncharoff.

Оде́сса. 7 Іюля 1916 г.
Ве́ксель на 750 Рубле́й.

По предъявле́ніи (at sight) сего́ ве́кселя пови́ненъ я заплати́ть Кіевскому купцу́ Ива́ну Степа́новичу Голи́цыну Семьсо́тъ пятьдеся́тъ рубле́й.

Оде́сскій купе́цъ Ла́зарь Семёновичъ Баряти́нскій.

Минскъ, 15 А́вгуста 1916 г.
Ве́ксель на 800 рубле́й.

Че́резъ шесть мѣ́сяцевъ по предъявле́ніи по сему́
Six months after presenting against this bill am
ве́кселю пови́ненъ я заплати́ть Обществу "Торо́н-
I to pay the Company "Toronton" in Petrograd
тонъ" въ Петрогра́дѣ восемьсо́тъ рубле́й.
eight hundred roubles.

Ми́нскій купе́цъ Абра́мъ Саму́иловъ Ги́нзбургъ.

Го́мель. 10 Ма́рта 1916 г.
Ве́ксель на 300 рубле́й.

По предъявле́ніи до 30 Апрѣ́ля 1916 го́да / въ тече́ніе четырёхъ мѣ́сяцевъ
After presenting up to 30 April, 1916, / within four months
по сему́ ве́кселю пови́ненъ я заплати́ть Ми́нскому
against this bill am I to pay the Minsk merchant
купцу́ Абра́му Саму́иловичу Ги́нзбургу три́ста
Abraham Samuel Ginsburg three hundred
рубле́й.
roubles.

Го́мельскій купе́цъ Соломо́нъ Иса́ковичъ Бро́йдо.

NOTE.—The idea of this bill is as follows: It is drawn on the 10th of March, but will be presented to Broido for acceptance or payment on the 30th of April, and he may make payment on it either on the same date or any day within four months from the 30th of April.

(b) Forms of Drafts

(Фо́рмы перево́дныхъ векселе́й; перево́довъ).

Москва́, 8 Сентября́ 1916 г.
Ве́ксель на 600 Рубле́й.

25-го Сентября́ 1916 го́да по сему́ ве́кселю заплати́те
On the 25th September, 1916, against this
Петрогра́дскому купцу́ Петру́ Никифо́ровичу Ники́-
bill pay to the Petrograd merchant Peter Nicephore
тину шестьсо́тъ рубле́й.
Nikitin six hundred roubles.

Ха́рьковскому купцу́ — Моско́вскій купе́цъ
To the Kharkoff merchant — The Moscow merchant
Ива́ну Пётровичу Пу́шкину. — Васи́лій Кири́лловичъ Смирно́въ.
Ivan Peter Pushkin. — Basile Cyrille Smirnoff.

NOTE.—Pushkin is the drawee, Smirnoff is the drawer in favour of Nikitin.

Петрогра́дъ. 17 Октября́ 1916 г.
Ве́ксель на 900 Руб.

Отъ сего́ числа́ че́резъ два мѣ́сяца заплати́те Това-
From this date in two months pay the partners of
ри́ществу "Бра́тья П. и Д. Ла́заревы" въ Петро-
the firm P. & D. Lazarevi Brothers in Petrograd,
гра́дѣ, Не́вскій Проспе́ктъ №. . . .девятьсо́тъ рубле́й.
Nefsky Prospekt, No. . . . . nine hundred roubles.

Оде́сскому купцу́ — Петрогра́дскій купе́цъ
To the Odessa merchant — The Petrograd merchant
Степа́ну Миха́йловичу Сала́еву — Никифо́ръ Васи́льевичъ Глазуно́въ.
Stephen Michael Salaeff. — Nicephorus Basil Glazunoff.

Петрогра́дъ. 10 Ноября́ 1916 г.
Ве́ксель на 1,500 Рубле́й.

По предъявле́ніи сего́ ве́кселя заплати́те Ми́нскому купцу́ Гаври́лу Ива́новичу Я́ковлеву одну́ ты́сячу пятьсо́тъ рубле́й.

Пско́вскому купцу́ — Петрогра́дскій купе́цъ.
Матвѣ́ю Сергѣ́евичу Бѣ́лкину — Я́ковъ Па́вловичъ Жуко́вскій.

(c) Inscriptions on Bills

(На́дписи на векселя́хъ).

INDORSEMENT IN FULL (именна́я переда́точная на́дпись):

Вмѣ́сто меня́ заплати́те Моско́вскому Купе́ческому Ба́нку.

Фёдоръ Па́вловичъ Спиридо́новъ.
Pay in lieu to the Moscow Merchants' Bank.
Theodor Paul Spiridonoff.

OPEN INDORSEMENT (бла́нковая переда́точная на́дпись):

Моско́вскій купе́цъ Фёдоръ Па́вловичъ Спиридо́новъ.

INDORSEMENT WITHOUT RECOURSE (безоборо́тная переда́точная на́дпись):

Безъ оборо́та на меня́. Моско́вскій купе́цъ Фёдоръ Па́вловичъ Спиридо́новъ.
Without recourse to me in case of non-payment.
The Moscow merchant Theodor Paul Spiridonoff.

TRANSFERENCE (препоручи́тельная на́дпись):

Платёжъ по сему́ ве́кселю препоруча́ю получи́ть купцу́ Ива́ну Си́доровичу Ивано́ву. Моско́вскій купе́цъ Фёдоръ Па́вловичъ Спиридо́новъ.
I hand over to receive payment on this bill to I. S. Ivanoff, merchant.

GUARANTY (поручи́тельная на́дпись);
За купца́ Па́вла А́ндреевича Боро́здина руча́юсь.
Моско́вскій купе́цъ Фёдоръ Па́вловичъ Спиридо́новъ.
I guarantee for P. A. Borosdin.

ACCEPT (По́дпись о приня́тіи или акце́птѣ):
При́нятъ (акцепто́ванъ). Моско́вскій купе́цъ Фёдоръ Па́вловичъ Спиридо́новъ.

INTERVENTION (Посредни́чество):
Посре́дникъ: Моско́вскій Купе́ческій Банкъ. (*Intermediary: The Moscow Merchants' Bank.*) Ф. П. Спиридо́новъ.

ACCEPTANCE FOR HONOUR (посредни́чество за честь):
Принима́ю ве́ксель за честь Моско́вскаго купца́ Фёдора Па́вловича Спиридо́нова. Моско́вскій купе́цъ Андре́й Гераси́мовичъ Шелгуно́въ.
I accept for the honour of the Moscow merchant, T. P. Spiridonoff.

Letters

Гисподи́ну 2 Апрѣля, 1916 г.
Ж. Лови́нскому,
Кни́гоизда́тельство,
въ Москвѣ.

Милости́вый Госуда́рь.

Удостовѣря́я получе́ніе Ва́шего уважа́емаго письма́ отъ 30-го про́шлаго м-ца каса́тельно пра́ва перево́да на́шего изда́нія "Руково́дство къ Хиру́ргіи" д-ра Бру́са Джонсъ, мы Васъ благодари́мъ за любе́зный запро́съ и симъ спѣши́мъ Вамъ сообщи́ть, что пра́во э́то ещё откры́то для ру́сскаго изда́нія, кото́рое мы гото́вы уступи́ть Вамъ на сле́дующихъ усло́віяхъ:

Текстъ: На́ше вознагражде́ніе за текстъ, на кото́рое полу́чите исключи́тельное пра́во перево́да на ру́сскій язы́къ, бу́детъ 25 фун. стер. за ка́ждый томъ.

Иллюстра́ціи: Какъ вы ви́дѣли, сочине́ніе содержитъ рису́нки въ свѣтѣ и тѣняхъ и цвѣтныя табли́цы въ по́лныя страни́цы. Кли́ше для пе́рвыхъ, гальвани́ческіе и хоро́шаго ка́чества, мы гото́вы отпусти́ть Вамъ по цѣнѣ шести пе́нсовъ за квадра́тный дюймъ, что равня́ется десяти́ санти́мамъ за квадра́тный са́нтиметръ. Для трёхцвѣтныхъ табли́цъ мы и́ли мо́жемъ доста́вить кли́ше по той же са́мой цѣнѣ, т. е., восемна́дцать пе́нсовъ за кв. дюймъ набо́ра въ три кли́ше, и́ли же, е́сли предпочтёте, мы бы могли́ доста́вить отпеча́танныя коли́чества табли́цъ, гото́выхъ къ употребле́нію, съ ру́сскимъ те́кстомъ и́ли безъ него́. Мы охо́тно гото́вы сдѣлать Вамъ предложе́ніе за 2000, 5000, и́ли ино́е коли́чество экземпля́ровъ въ сообра́зности съ объёмомъ изда́нія, кото́рое Вы имѣете въ виду́. Сто́имость пересы́лки не включена́ въ нашей расцѣнкѣ.

Мы охо́тно гото́вы служи́ть Вамъ по жела́нію всѣ́кими дальнѣ́йшими свѣ́дѣніями и ждёмъ съ интере́сомъ Ва́шего рѣше́нія.

Съ соверше́ннымъ почте́ніемъ,
Ка́ссель и Компа́нія, Ли́митедъ,
Иностра́нный Отдѣлъ.

Notes

Удостовѣря́я получе́ніе,	*We beg to acknowledge the receipt.*
каса́тельно,	*with regard to, concerning.*
пра́во перево́да,	*translation rights.*
изда́ніе,	*publication.*
кни́гоизда́тельство,	*publisher, publishers.*
руково́дство къ хиру́ргіи,	*Manual of Surgery.*
любе́зный запро́съ,	*kind inquiry.*
спѣши́мъ сообщи́ть,	*we hasten to inform, communicate.*
ещё откры́то,	*is still open, available.*
гото́вы уступи́ть,	*are prepared to grant transfer.*
на сле́дующихъ усло́віяхъ,	*on the following terms.*
текстъ,	*the text.*
вознагражде́ніе,	*the fee.*
исключи́тельное,	*the exclusive.*
иллюстра́ціи, рису́нки,	*illustrations.*
какъ Вы ви́дѣли,	*as you have seen.*
сочине́ніе,	*the work.*
содержитъ,	*contains.*
въ свѣтѣ и тѣняхъ,	*in light and shades, in black and white.*
цвѣтны́я табли́цы,	*coloured tables.*
въ по́лныя страни́цы,	*full page.*
кли́ше,	*blocks.*
для пе́рвыхъ,	*for the former.*
гальвани́ческіе,	*galvanos.*
отпусти́ть по цѣнѣ,	*deliver, supply at the price.*
равня́ется,	*equals.*
доста́вить,	*supply, deliver.*
по той же са́мой,	*at the same.*
набо́ръ,	*a set.*
е́сли предпочтёте,	*if you prefer.*
отпеча́танныя коли́чества,	*printed sets, quantities.*
гото́выхъ къ употребле́нію,	*ready for use.*
охо́тно,	*gladly.*
сдѣлать предложе́ніе,	*to quote, make an offer.*
ино́е коли́чество экземпля́ровъ,	*any other quantity of copies.*
въ сообра́зности,	*in accordance.*
объёмъ,	*the size.*
имѣть въ виду́,	*to have in view.*
сто́имость пересы́лки,	*freight charges.*
не включена́,	*is not included.*
расцѣнка,	*the estimate.*
служи́ть,	*to serve with, to give.*
по жела́нію,	*at desire, you may desire.*
всѣ́кими дальнѣ́йшими свѣ́дѣніями,	*any further information.*
ждёмъ съ интере́сомъ,	*we await with interest.*
рѣше́ніе,	*the decision.*
иностра́нный отдѣлъ,	*Foreign Department.*

16 Апрѣля ....

Госпожѣ
Ж. Ту́рневиль,
Бульва́ръ де-Тилеиль, 63,
въ Ту́рѣ.

Ми́лостивая Госуда́рыня.

Симъ подтвержда́емъ получе́ніе В/. уважа́емаго письма́ отъ 12-го с/м. съ запро́сомъ о пра́вѣ перево́да

на францу́зскій язы́къ нѣкоторыхъ кра́ткихъ повѣсте́й въ на́шихъ журна́лахъ. Въ отвѣтъ на Вашъ запро́съ честь имѣемъ Вамъ сообщи́ть, что пра́во перевода́ **не** откры́то **для всѣхъ** повѣсте́й, появи́вшихся въ на́шихъ журна́лахъ, но мы имѣемъ возмо́жность предоставля́ть пра́во перево́да на нѣкоторыя изъ нихъ.

Одновре́менно съ симъ имѣемъ удово́льствіе препровести́ Вамъ подъ отдѣльнымъ покры́тіемъ по одному́ экземпля́ру ка́ждаго изъ на́шихъ журна́ловъ, гдѣ найдёте въ оглавле́ніяхъ отмѣченными тѣ по́вѣсти, перево́дъ ко́ихъ откры́ть. Надѣемся, что нѣкоторыя изъ нихъ ока́жутся соотвѣтствующими Ва́шей цѣли. Вы та́кже найдёте тамъ отмѣтку о на́шемъ вознагражде́ніи за ка́ждую по́вѣсть.

Мы охо́тно гото́вы предлага́ть Вамъ посто́янно матерья́лъ для перево́довъ, когда Вамъ потре́буется.

Пребыва́емъ,

Съ соверше́ннымъ почте́ніемъ,

Ка́ссель и Компа́нія, Ли́митедъ,

Иностра́нный отдѣлъ.

Notes

Симъ подтвержда́емъ,	*we hereby confirm.*
на францу́зскій язы́къ,	*into French.*
нѣкоторыхъ,	*some.*
кра́ткая по́вѣсть	*a short story.*
журна́лъ,	*magazine.*
въ отвѣтъ,	*in reply.*
не откры́то,	*not open, not available.*
появи́вшихся,	*that appeared.*
во вся́кое вре́мя,	*at all times, always.*
имѣть возмо́жность,	*to be in a position.*
предоставля́ть,	*to grant.*
одновре́менно съ симъ,	*simultaneously.*
удово́льствіе,	*pleasure.*
препровести́,	*to send, forward.*
подъ отдѣльнымъ покры́тіемъ,	*under separate cover.*
по одному́,	*each of, one of each.*
найдёте,	*you will find.*
оглавле́ніе,	*index.*
отмѣченными,	*marked.*
ока́жутся,	*will prove.*
соотвѣтствующими цѣли,	*suitable for the purpose.*
отмѣтка,	*a note.*
предлага́ть матерья́лъ,	*to offer material.*
посто́янно,	*continually.*
когда́ потре́буется,	*when needed.*
пребыва́емъ,	*we are.*

The Travellers' Companion

Selected Phrases and Terms for the Use of Travellers in Russia

A—The Time

1. Вре́мя.	*Time.*
2. Въ послѣднее вре́мя.	*Lately.*
3. Въ было́е вре́мя.	*In the past.*
4. Въ настоя́щее вре́мя.	*At present.*
5. Тепе́рь не вре́мя.	*It is not the time now.*
6. У меня́ нѣтъ вре́мени.	*I have no time.*
7. Мно́го свобо́днаго вре́мени.	*Much leisure.*
8. Въ свое́ вре́мя.	*In due course; in due time; in its time.*
9. Во́время. Не во́время.	*In* or *at the right time; at the wrong time.*
10. Въ пе́рвый разъ.	*The first time.*
11. Въ пе́рвое вре́мя.	*At first; at the beginning.*
12. Въ са́мое коро́ткое вре́мя.	*Very shortly.*
13. Со вре́менемъ.	*In time; in the long run.*
14. Въ како́е вре́мя.	*At what time* (hour)?
15. Въ одно́ вре́мя.	*At one time* (set hour).
16. Въ ра́зное вре́мя.	*At different times* (hours).
17. Въ са́момъ ско́ромъ вре́мени.	*Very soon.*
18. Къ назна́ченному вре́мени.	*At the appointed time.*
19. Съ нѣкотораго вре́мени.	*For some time.*
20. До сего́ вре́мени.	*Up to now.*
21. До того́ вре́мени.	*Until then.*
22. Пора́ спать.	*It is time to go to bed.*
23. Уже́ по́здно.	*It is already late.*
24. Ещё ра́но.	*It is early yet.*
25. Ра́но у́тромъ.	*Early in the morning.*
26. По́здно но́чью.	*Late at night.*
27. Часъ.	*An hour.*
28. Кото́рый часъ?	*What is the time?*
29. Въ кото́ромъ часу́?	*At what time?*
30. Тепе́рь ро́вно часъ.	*It is just one o'clock now.*
31. Часы́ (plur.).	*A clock, a watch.*
32. Часы́ бьютъ два.	*The clock strikes two.*
33. Тепе́рь четверть втора́го.	*It is now a quarter past one.*
34. Ещё нѣтъ полови́ны тре́тьяго.	*It is not half past two yet.*
35. Тепе́рь безъ пяти́ мину́тъ четы́ре.	*It is now five to four.*
36. На мои́хъ часа́хъ пять часо́въ.	*It is five by my watch.*
37. На мои́хъ три че́тверти пя́таго.	*It is a quarter to five by mine.*
38. Я завёлъ мои́ часы́ по почта́му.	*I have wound up* (set) *my watch by the Post Office.*
39. Какъ разъ въ два́дцать мину́тъ втора́го.	*Precisely at twenty minutes past one.*
40. Въ полови́ну шеста́го пойду́ въ теа́тръ.	*At half past five I am going to the theatre.*
41. Приди́те въ де́сять часо́въ утра́.	*Come, please, at ten in the morning.*
42. По́слѣ четверти двѣна́дцатаго.	*After a quarter past eleven.*
43. До восьми́ часо́въ я бу́ду въ го́родѣ.	*Till eight o'clock I shall be in town.*
44. Я Васъ бу́ду ждать до се́ми часо́въ.	*I shall wait for you till seven.*
45. По́слѣ девяти́ меня́ не заста́нете до́ма.	*After nine you will not find me at home.*
46. Я бу́ду въ но́мерѣ до че́тверти девя́таго.	*I shall be in my room till a quarter past eight.*
47. Уѣзжа́ю въ два часа́ но́чью.	*I am leaving at two in the morning.*

48. Подождáте одну минýту. *Wait one minute.*
49. Когдá бýдете свобóдны? *When are you at liberty?*
50. Могý ли Васъ вúдѣть въ Суббóту? *Can I see you on Saturday?*
51. Я óчень зáнятъ въ тотъ день. *I am very busy that day.*
52. Не мóжете ли придти въ Пя́тницу? *Can you come on Friday?*
53. Я придý къ Вамъ въ Срéду. *I shall come to see you on Wednesday.*
54. Зáняты ли Вы въ Воскресéнье? *Are you busy on Sunday?*
55. По воскресéньямъ сижý на дáчѣ. *I spend the Sundays in the country.*
56. Какóй день сегóдня? *What day is to-day?*
57. Сегóдня Понедѣ́льникъ. *It is Monday.*
58. Я дýмалъ, что втóрникъ. *I thought it was Tuesday.*
59. Какóе числó бýдетъ въ четвéргъ? *What date will it be on Thursday?*
60. Двáдцать пя́тое Января́. *The twenty-fifth of January.*
61. Въ Январѣ́ или Февралѣ́. *In January or February.*
62. Отъ Мáрта до Апрѣ́ля. *From March to April.*
63. Пóслѣ Мáя мѣ́сяца. *After May.*
64. Въ нача́лѣ Ію́ня. *At the beginning of June.*
65. Въ концѣ́ Ію́ля. *At the end of July.*
66. Въ срéднихъ числáхъ Áвгуста. *In the middle of August.*
67. Седьмóго Сентября́. *The seventh September.*
68. Съ Октября́ мѣ́сяца. *Since October.*
69. До пятна́дцатаго Ноября́. *Till the fifteenth November.*
70. Двáдцать трéтьяго Декабря́. *The twenty-third December.*
71. Въ пóлдень и́ли по полу́дню. *At noon or in the afternoon.*
72. Сегóдня и́ли зáвтра. *To-day or to-morrow.*
73. Сегóдня вéчеромъ. *This evening.*
74. До полу́ночи и въ пóлночь. *Till midnight and at midnight.*
75. Чéрезъ нѣ́сколько дней. *In a few days.*
76. Чéрезъ нѣ́сколько мѣ́сяцевъ. *In a few months.*
77. На нѣ́сколько минýтъ. *For a few minutes.*
78. Вчерá и третьяго дня. *Yesterday and the day before.*
79. До тридцáти дней. *Up to thirty days.*
80. Отъ двухъ до трёхъ мѣ́сяцевъ. *From two to three months.*
81. Отъ шести́ до девяти́ мѣ́сяцевъ. *From six to nine months.*
82. Не мéнѣе одного́ гóда. *Not less than a year.*
83. Сейчáсъ и́ли потóмъ. *Directly* (now, at once), *or after.*
84. Черéзъ день и́ли два. *In a day or two.*
85. Пóслѣ-зáвтра. *The day after to-morrow.*
86. Пришлá зимá. *Winter has come.*
87. Настáла óсень. *Autumn has begun.*
88. Чрезъ всё лѣ́то. *Through all the summer.*
89. Веснóю. На веснý. *In spring time; towards spring.*
90. Къ сезóну. *For the season.*
91. Сезонъ прошёлъ. *The season is past.*
92. На Нóвый Годъ. *For New Year.*
93. Пóслѣ Рождествá Христóва. *After Christmas.*
94. Тепéрь Máсляница. *It is carnival now.*
95. Подождúте до Святóй Пáсхи. *Wait till Easter.*
96. Въ э́томъ годý. *This year.*
97. Въ прóшломъ годý. *Last year.*
98. Въ бýдущемъ годý. *Next year.*
99. На э́той недѣ́лѣ. *This week.*
100. На прóшлой недѣ́лѣ. *Last week.*
101. На бýдущей недѣ́лѣ. *Next week.*
102. Въ бýдущемъ. *In the future.*
103. Чéрезъ двѣ недѣ́ли. *In a fortnight.*
104. Чéрезъ мѣ́сяцъ. *In a month.*
105. Тотчáсъ. Срáзу. *At once.*
106. Немéдленно. *Immediately.*
107. Безотлагáтельно. *Without delay.*
108. Моментáльно. *In a moment, instantly.*
109. Всегдá. *Always.*
110. Постóянно. *Continually.*
111. Чáсто. *Often.*
112. Рѣ́дко. *Seldom.*
113. Когдá нибýдь. *Some day.*
114. Отъ поры́ до врéмени. *Now and then.*
115. По временáмъ. *Sometimes.*
116. Изó дня въ день. *From one day to another.*
117. Вѣ́чно. *Eternally.*
118. Какъ дóлго? *How long?*
119. Скóлько врéмени? *How much time?*
120. Во скóлько врéмени? *In how much time?*
121. Недóлго. *Not long.*
122. Корóткое врéмя. *A short time.*
123. Когдá. *When.*
124. Тогдá. *Then.*
125. Никогдá. *Never.*

B—Hotels, etc.

126. Первоклáссная гости́ница. *First-class hotel.*
127. Содержáтель гости́ницы. *Hotel proprietor.*
128. Служéбный персонáлъ. *Staff.*
129. Швейцáръ. *Porter.*
130. Номерно́й. *Corridor man; bedroom waiter.*
131. Двóрникъ, сторóжъ. *Doorkeeper, caretaker.*
132. Коммиссіонéръ. *Commissioner.*
133. Разсы́льный. *Messenger, page.*
134. Носи́льщикъ. *Packman, carrier, porter.*
135. Гóрничная. *Chambermaid.*
136. Сѣ́ни, передняя. *Lobby, passage, entrance hall.*

137. Ни́жній э́таж ь и́ли парте́ръ.	*Ground-floor.*
138. Пе́рвый эта́жъ.	*First floor.*
139. Подъёмная маши́на.	*Lift.*
140. Пра́вый корридо́ръ.	*The right* (side) *corridor.*
141. Лѣвый корридо́ръ.	*The left* (side) *corridor.*
142. Лѣстница.	*Staircase.*
143. Балко́нъ.	*Balcony.*
144. Клозе́ть, ватерклозе́ть.	*Water-closet.*
145. Но́меръ.	*Apartment, room.*
146. Съ ви́домъ на у́лицу.	*With a view on the street.*
147. Съ ви́домъ во дворъ.	*With a view into the yard.*
148. Покажи́те тотъ но́меръ.	*Show me that room.*
149. Этотъ но́меръ сейча́съ за́нятъ.	*This room is occupied at present.*
150. Онъ ско́ро освобо́дится.	*It will be soon set free.*
151. Всѣ номера́ за́няты.	*All the rooms are occupied.*
152. То́лько э́ти два свобо́дны.	*Only these two are free.*
153. Они́ мнѣ не нра́вятся.	*I do not like them.*
154. Въ чёмъ дѣло?	*What is the matter?*
155. Потоло́къ ни́зокъ.	*The ceiling is low.*
156. Они́ ка́жутся тёмными.	*They seem to be dark.*
157. Какъ здѣсь ду́шно!	*How sultry it is here!*
158. Что Вы за нихъ счита́ете?	*What are you charging for them?*
159. Это цѣна́ въ су́тки.	*This is the price per day.*
160. Ско́лько посчита́ете въ недѣлю?	*How much will you reckon a week?*
161. Ско́лько вре́мени намѣрены Вы у насъ стоя́ть?	*How long do you intend staying with us?*
162. Быть мо́жетъ отъ трёхъ до пяти́ недѣль.	*From three to five weeks, perhaps.*
163. Я жела́ю та́кже усло́виться насчёт обѣдовъ, у́жиновъ и про́чее.	*I also wish to make arrangements with regard to dinners, supper, and so on.*
164. Съ удово́льствіемъ, су́дарь.	*With pleasure, Sir.*
165. У насъ хоро́шая ку́хня.	*We have a good cuisine.*
166. Самова́ръ три ра́за въ су́тки.	*You will have the samovar three times a day.*
167. За по́лное продово́льствіе посчита́ю Вамъ.....въ недѣлю.	*For the full board I shall charge you . . . per week.*

Key to Exercise 33

1. Невозмо́жно вести́ дѣло безъ де́негъ. 2. Для по́льзы дѣла мы должны́ печа́тать но́вые катало́ги. 3. Я вы́нужденъ оста́вить това́ръ до Ва́шего распоряже́нія. 4. Изъ Сибири мы получа́емъ я́йца и ма́сло. 5. Я отка́зываюсь отъ э́той небезпе́чной сдѣлки. 6. Ско́лько де́негъ есть у Васъ нали́чными. 7. Изъ-за пусто́й форма́льности мы потеря́ли парохо́дъ. 8. Я намѣреваюсь ѣхать въ Ло́ндонъ чрезъ недѣлю. 9. Онъ постоя́нно сиди́тъ надъ кни́гами. 10. При доста́точныхъ сре́дствахъ и хоро́шей энергіи дѣло должно́ процвѣта́ть. 11. Ме́жду нимъ и мно́ю нѣтъ спо́ра и́ли недоразуме́нія. 12. Господа́ С. благодаря́тъ насъ въ письмѣ за аккура́тное выполне́ніе ихъ зака́за. 13. Я не могу́ отпусти́ть Вамъ э́того предме́та за ши́ллингъ. 14. Мы не успѣ́емъ око́нчить э́того за недѣлю. 15. Возьме́мся наконе́цъ за дѣло. 16. Вы меня́ всегда́ найдёте за конто́ркой. 17. Пошли́те за стопо́й пако́вочной бума́ги. 18. Что за стра́нный вопро́съ! 19. Я имѣю весь персона́лъ пе́редъ мои́ми глаза́ми. 20. Зака́зная кни́га постоя́нно нахо́дится подъ мои́ми рука́ми.

Key to Exercise 34

1. We hope that our trade with Russia will gradually increase from year to year. 2. For some time previous to the declaration of war between the Central Powers and the Allies British exports to and imports from Russia have little by little attained considerable dimensions. 3. If properly handled, the trade between the United Kingdom and the New Republic (formerly Empire) of Russia ought to develop almost indefinitely. 4. The outbreak of the Great European War in 1914 put an end to all trade between Germany (including Austria, Bulgaria and Turkey) and Russia. 5. This circumstance should enable Great Britain to secure a large part of the trade which hitherto was done by the Central Powers. 6. Russia is an immense market with a great future, and the Russians are very well disposed towards their Allies, so that the latter are placed in a very favourable position for developing their trade with that enormous State. 7. Among the articles exported by Great Britain to Russia we find machinery, iron and coal. 8. Further,we notice cotton textiles and cotton yarn,wool,woollen goods and worsted yarn, copper, implements and tools, lead, chemicals, and herrings. 9. Of the articles we import from Russia into Great Britain the principal are: sawn and hewn timber, cereals such as wheat, oats, barley, maize, and raw materials such as flax, hemp and bristles. 10. We also receive from Russia: manganese ore, paper and wood pulp, linseed, naphtha, goat-skins, horses, peas, butter and eggs, poultry and game. 11. Enclosed you will find a list in a concise form of the principal articles exported to, and imported from, Russia together with the value in millions of roubles or of pounds sterling. 12. It will certainly be of great interest to every Russian and British merchant to have placed before him all these particulars in a concise form. 13. Please give us details of the goods sent by Great Britain to Russia in the year 1913, as also of the articles imported by Great Britain from that country during the same year. 14. At the same time you might draw up for us a list of the principal goods forming the general Russian imports and exports for the same period . . . with the whole world.

Key to Exercise 35

1. Нѣтъ основа́нія, почему́ на́ша торго́вля съ Россіей при до́лжномъ внима́ніи не могла́ бы быть ра́звита до безконе́чности. 2. Изъ гла́вныхъ предме́товъ, вывози́мыхъ Россіей, Великобрита́нія получа́етъ приблизи́тельно два́дцать проце́нтовъ, состоя́щихъ изъ пита́тельныхъ веще́ствъ, льна, пѣса, са́хара, ма́сла, бума́жныхъ издѣлій, сыры́хъ шкуръ, не́фти и произведе́ній, марга́нцевой руды́, лошаде́й, я́ицъ, плати́ны и се́мя́нъ. 3. Продолжа́я сей спи́сокъ о́бщихъ ру́сскихъ выво́зовъ, мы име́емъ: мѣха́ и шку́рки, рога́тый скотъ, пти́цу и дичь, шерсть, щети́ну, таба́къ и икру́. 4. Въ заключе́ніе спи́ска упомя́немъ: спиртъ, рези́новыя издѣлія, желѣзную руду́, ры́бу, металли́ческія издѣлія и ко́нскій во́лосъ. 5. Среди́ предме́товъ, ввози́мыхъ Великобрита́ніей изъ Россіи, суть: овёсъ, кукуру́за, пѣсъ, ма́сло, я́йца, льняно́е се́мя, ло́шади, нефть, ячме́нь и горо́хъ. 6. Мы име́емъ, наконе́цъ, марга́нцевую руду́, лёнъ; пти́цу и дичь, бума́жную и древе́сную ма́ссу, пшени́цу, пе́ньку, па́клю и ко́зьи шку́рки. 7. Въ отноше́ніи предме́товъ, вывози́мыхъ Великобрита́ніей въ Россію, главнѣ́йшими суть: хими́ческія издѣлія, ма́шины, ору́дія и инструменты, ка́менный у́голь, се́льди, желѣзо, шерстяны́е това́ры и ка́мвольная пря́жа, мѣдь, шерть, хлопча́то-бума́жныя издѣлія и бума́жная пря́жа и свине́цъ.

A. C.

GREEK.—XIII

The Augment

It will be well now to consider the three forms of the augment—the syllabic, the temporal, and the reduplicative—in more detail.*

The three verbs, *βούλομαι, I will*, *δύναμαι, I am able* or *can*, and *μέλλω, I intend*. The temporal augment is sometimes combined with the syllabic, thus :—

Imperfect	*Aorist*
ἐβουλόμην or ἠβουλόμην	ἐβουλήθην or ἠβουλήθην
ἐδυνάμην or ἠδυνάμην	ἐδυνήθην or ἠδυνήθην
ἔμελλον or ἤμελλον	

The temporal augment consists in the lengthening of an initial vowel, thus :—

α	becomes	η,	as in	ἄγω, *lead*, ἦγον, ἦχα, ἦχη, ἦχθην.
ᾳ	,,	ῃ,	,,	ᾄδω, *sing*, ᾖδον.
ε	,,	η,	,,	ἐλπίζω, *hope*, ἤλπιζον, ἤλπικα, ἠλπίκη.
ι	,,	ῑ,	,,	ἱκετεύω, *entreat*, ἱκέτευον, ἱκέτευκα, ἱκετεύκη.
ο	,,	ω,	,,	ὁμιλέω, *accompany*, ὡμίλουν, ὡμίληκα, ὡμιλήκη.
αι	,,	ῃ,	,,	αἱρέω, *take*, (ἕρεον) ἕρουν, ἥρηκα, ἠρήκη, ἠρέθην.
ῠ	,,	ῡ,	,,	ὕβρίζω, *insult*, ὕβριζον, ὕβρικα, ὑβρίκη, ὑβρίσθην.
αυ	,,	ηυ	,,	αὐλέω, *play on the flute*, (ηὔλεον), ηὔλουν, ηὔληκα, ηὐλήκη.
ευ	,,	ηυ	,,	εὑρίσκω, *find*, ηὕρισκον, ηὗρον, ηὕρηκα, (ηυ- or ευ-).
οι	,,	ῳ,	,,	οἰκτίζω, *pity*, ᾠκτιζον, ᾤκτικα, ᾠκτίκη.

The augment does not appear in verbs beginning with η, ῑ, ῡ, ω, or ου, since the initial syllables are already long, thus :—

ἡττάομαι, I submit, I am inferior, ἥττημαι, ἡττήμην.

Initial ᾱ, however, usually is augmented to η, as in *ἀθλέω, struggle*, ἠθλησα.

Some verbs take the syllabic augment instead of the temporal, e.g. :—

ἄγνυμι, break, ἔαξα, 2 perf. ἔᾱγα, *I am broken*.
ἀνδάνω, please, ἥνδανον, ἐάνδανον, perf. ἔᾱδα, 2 aor. ἔᾱδον.

In this case εε, that is, the syllabic augment followed by an initial ε, contracts to ει, as in :—

ἐάω, permit, imp, εἴων, εἴᾱσα, εἴᾱκα.
ἐθίζω, accustom, εἰθῖσα, εἴθικα.
ἔχω, have, imp. εἶχον, 2nd aor., ἔσχον.

The temporal augment is taken after the syllabic, as in the following :—

ὁράω, behold, ἑώρων, perf. ἑώρᾱκα or ἑόρακα, ἑώρᾱμαι.

Reduplication is used as the mark of the perfect tenses in most verbs beginning with a single consonant or with a mute or a liquid. But verbs beginning with ρ, with two consonants (except a mute and liquid other than γν), or with a double consonant (ζ, ξ, ψ), take the simple syllabic augment. The pluperfect usually prefixes the syllabic augment to the reduplication; when there is no reduplication it usually has the same augment as the perfect.

	Perfect.	*Pluperfect.*
λύω, loose	λέλυκα	ἐλέλυκη
θύω, sacrifice	τέθυκα	ἐτεθύκη
φυτεύω, plant	πεφύτευκα	ἐπεφυτεύκη
χορεύω, dance	κεχόρευκα	ἐκεχορεύκη
γράφω, write	γέγραφα	ἐγεγράφη
κλίνω, bend	κέκλικα	ἐκεκλίκη
κρίνω, judge	κέκρικα	ἐκεκρίκη
πνέω, breathe	πέπνευκα	ἐπεπνεύκη
θλάω, break	τέθλακα	ἐτεθλάκη
ῥίπτω, throw	ἔρρῐφα	ἐρρῐφη
γνωρίζω, make known	ἐγνώρικα	ἐγνωρίκη

The two verbs *μιμνήσκω* (stem *μνα-*), *remind*, and *κτάομαι, acquire*, take the reduplication; thus, *μέμνημαι, ἐμεμνήμην, κέκτημαι* (also ἔκτημαι), *possess*, ἐκεκτήμην.

Five verbs beginning with a liquid take ει as augment instead of the reduplication, viz. :—

λαμβάνω, I take	εἴληφα	εἰλήφη
λαγχάνω, I get by lot	εἴληκα	εἰλήκη
λέγω, συλλέγω, collect	συνείλοχα	συνειλόχη
εἶπον, said, (no present)	εἴρηκα (stem ῥε)	εἰρήκη
μείρομαι, obtain	εἵμαρται, *it is determined*.	

Several verbs beginning with α, ε, or ο augment the perfect and pluperfect by prefixing the first two letters of the stem to the temporal augment, as follows :—

ἀρόω, plough	ἀρήρομαι	ἀρηρόμην
ἐλέγχω, examine	ἐλήλεγμαι	ἐληλέγμην
ὀρύσσω, dig, 2nd perf. ὀρώρυχα, ὀρωρύχη, ὀρώρυγμαι, ὀρωρύγμην.		

The Augment in Compound Verbs

Verbs compounded with a preposition take the augment between the preposition and the primitive verb. In this change prepositions (except *περί* and *πρό*) drop a final vowel before the augment ε, *πρό* usually contracting with the ε forming πρου. The ν in *σύν* and *ἐν*, when dropped or assimilated to the initial consonant of the verb reappears before the ε; ἐκ becomes ἐξ. The following are examples :—

Present.	*Imperfect.*	*Perfect.*	*Pluperfect.*
ἀπο-βάλλω, *throw away*,	ἀπ-έβαλλον	ἀπο-βέβληκα	ἀπ-εβεβλήκη
προ-βάλλω, *throw before*,	προ-έβαλλον προύβαλλον	προ-βέβληκα	προ-εβεβλήκη προυβεβλήκη
ἐκ-βάλλω, *throw out*,	ἐξ-έβαλλον	ἐκ-βέβληκα	ἐξ-εβεβλήκη
συλ-λέγω, *collect*,	συν-έλεγον	συν-είλοχα	συν-ειλόχη
ἐγ-γίγνομαι, *arise in*,	ἐν-εγιγνόμην	ἐγ-γέγονα	ἐν-εγεγόνη
ἐμ-βάλλω, *throw in*,	ἐν-έβαλλον	ἐμ-βέβληκα	ἐν-εβεβλήκη

Some verbs compounded with prepositions take the augment both before the preposition and before the stem, thus :—

ἀνορθόω, set upright,	ἠνώρθουν	ἠνώρθωκα	ἠνώρθωσα
ἀνέχομαι, support,	ἠνειχόμην	ἠνέσχημαι	ἠνεσχόμην

* In mastering the conjugations of Greek verbs it is, however, sufficient for elementary students to be guided by the principal parts of the verbs, which should be thoroughly learnt.

There are verbs in which the preposition and the verb have so coalesced as to present the signification of a simple verb. Examples :—

ἀμφιγνοέω, *doubt,*	ἠμφιγνόουν and ἠμφεγνόουν	ἠμφεγνόησα
ἀμφιέννυμι, *put on, clothe,*	ἠμφίεσα	ἠμφίεσμαι

Letters may be classified to show the possible combinations at the beginning of verbs. There are nine mutes, the gutturals γ, κ, χ, the labials, β, π, φ, and the dentals δ, τ, θ, when these are followed by any of the four liquids λ, μ, ν, ρ ; the mute only is repeated when reduplication is required for the perfect tenses. (The combination γν is an exception, hence ἔγνωκα where one might expect γέ-γνωκα). There are, of course, also compounds with σ.

VOCABULARY

ἀναρπάζω, *snatch, seize.*
ἅπαξ, *once.*
ἀποκτείνω, *kill.*
αὔριον, *to-morrow.*
βίος, ὁ, *life.*
βλαβή, -ῆς, ἡ, *injury.*
ἐκνέω, fut. ἐκνεύσομαι, *swim out.*
ἐναντίος, -α, -ον, *opposite.*
ἡγέομαι, *lead, guide, think, suppose.*
θέω, θεύσομαι, *run.*
καταδύω, *go down, sink.*
κατακαίω, *burn down.*
κόλπος, -ου, ὁ, *bosom, gulf.*
κλαίω, *weep, bewail.*
Κρισαῖος, -α, -ον, *Crisæan.*
ναυμαχία, -ας, ἡ, *sea-fight.*
ὅπλον, τὸ, *weapon,* plur. *arms.*
Πελοποννησίος, ὁ, *Peloponnesian.*
πίστις, -εως, ἡ, *faith, fidelity.*
πίπτω, *fall.*
πνέω, fut. πνεύσομαι, *blow, breathe.*
πύλη, -ης, ἡ, *door, gate.*
συγχέω, *pour together, confound.*
συνηθεία, -ας, ἡ, *intercourse, companionship.*
συμπίνω, *drink with, drink together.*
τίκτω, *bring forth.*
φονεύω, *kill, murder.*
χαίρω, *rejoice.*

Exercise 13

(*a*) Translate into English :—

1. Ἡ στρατία ἐξέπλευσεν. 2. Ἡ στρατία αὔριον ἐκπλευσεῖται. 3. Πάντες οἱ ἄνεμοι ἐναντιοι τῇ στρατίᾳ ἔπνευσαν. 4. Οἱ στρατιῶται ἤλπισαν θεύσεσθαι πρὸς τὰς πύλας. 5. Οἱ πολεμίοι τὰς τῶν στρατιωτῶν τάξεις συγχεύσουσιν. 6. Ἡ πόλις ὑπὸ τῶν πολεμίων κατακέκαυται.

(*b*) Translate into Greek :—

1. The wind blew against the expedition. 2. In the sea-fight in the Crisæan gulf the Peloponnesians slew as many of the Athenians as did not escape by swimming. 3. When the enemy approach the city, the soldiers will seize their arms and rush to the gates. 4. Who would not weep for a friend in distress ? 5. The life of our time has confounded faith. 6. The enemy threw the ranks of the Athenians into confusion.

Key to Exercise 12

(*a*) 1. Noble young men will follow virtue. 2. The citizens regarded the general as worthy of great honour. 3. The physicians healed the wound. 4. No one will acquire praise by means of pleasures. 5. If thou judgest wrongly, God will afterwards judge thee. 6. The letter has been written by the boy.

(*b*) 1. Ἡ βασιλεία ὑπὸ τοῦ δήμου λέλυται. 2. Ἱρὸ τοῦ ἔργου εὖ βεβούλευσο. 3. Πᾶσιν ἀνθρώποις ἐμπεφυτευμένη ἐστὶν ἐπιθυμία τῆς αὐτονομίας. 4. Ἡ θύρα κεκλείσθω. 5. Οἱ πολεμίοι εἰς τὴν ἄκραν κατακεκλείσθαι λέγονται. 6. Οἱ βόες κατακεκλείσθαι λέγονται. E. A. B.

ITALIAN.—XV

The Subjunctive Mood. — After most verbs which express a wish, command, fear, doubt, consent, request, surprise, wonder, the Subjunctive Mood is used, unless the Infinitive can take its place. The principal verbs requiring the Subjunctive are :—

aver paúra, *to be afraid.*
aver piacere, *to like.*
bramare, *to desire.*
chiédere, *to request.*
comandare, *to order.*
consentire, *to consent.*
crédere, *to believe.*
desiderare, *to desire.*
dispiacersi, *to be sorry.*
dolersi, *to regret.*
dubitare, *to doubt.*
esígere, *to exact.*
far attenzione, *to take care.*
godere, *to be glad.*
immaginare, *to imagine.*
impedire, *to prevent.*
insístere, *to insist.*
inténdere, *to intend.*
lasciare, *to let, allow.*
maravigliarsi, *to wonder.*
negare, *to deny.*
pensare, *to think.*
perméttere, *to permit.*
preferire, *to prefer.*
preténdere, *to claim.*
rallegrarsi, *to rejoice.*
richiédere, *to request.*
rincréscersi, *to be sorry.*
sospettare, *to suspect.*
sperare, *to hope.*
stupirsi, *to be surprised.*
supporre, *to suppose.*
temere, *to fear.*
volere, *to wish, want.*

The Indicative Mood, however, is also used after some of these verbs, as : **Crediamo che é così**, *We think it is so,* or **Crediamo che sía così**.

Even when the Indicative is wrongly used for the Subjunctive, the meaning is generally quite clear, and the fault is only a grammatical one.

Examples :—

L'ho pregato che imposti (subjunctive of *impostare*) le súe léttere súbito e che mi risponda sempre a giro di posta.	*I have asked him to post his letters at once and always to reply to me by return of post.*
Gli rincrebbe ch'io non vi fossi presente.	*He was sorry that I was not there.*
Vi prego che lo faccia a mezzodì.	*I request you to do it* (*or* to do so) *at midday.*

Ordinal Numbers:

1st	primo	21st	ventesimoprimo(*a*)
2nd	secondo	22nd	ventesimosecondo (*a*)
3rd	terzo	30th	trentésimo
4th	quarto	40th	quarantésimo
5th	quinto	50th	cinquantésimo
6th	sesto	60th	sessantésimo
7th	séttimo	70th	settantésimo
8th	ottavo	80th	ottantésimo
9th	nono	90th	novantésimo
10th	décimo	100th	centésimo
11th	decimoprimo (*a*)	104th	centesimoquarto
12th	decimosecondo (*a*)	200th	duecentésimo
13th	decimoterzo (*a*)	1,000th	millésimo
20th	ventésimo		

(*a*) or undicésimo ; dodicésimo ; tredicésimo ; ventunésimo, etc. (more usual in conversation).

Ordinal numbers form the feminine and plural regularly.

Cardinal numbers are used in Italian for the days of the month, except *the first*, **il primo.** The same kind of construction is used in French.

Examples :—

Il (*or* li) diciassette luglio è un giovedì.	*The 17th July is a Thursday.*

(Li is sometimes used instead of il, as : **li cinque,** *the fifth* (of the month).

Ci siamo stabiliti qui il primo gennáio di quest'anno.	*We established ourselves here on 1st January of this year.*
Dátemi una mezza libbra di butirro (burro).	*Give me half a pound of butter.*

Observe that verbs of fearing take **non** before the following verb when the realisation of the action of the latter is not desired, whereas the words **non . . . affatto, non . . . punto, non . . . mica** are used with the second verb when we fear the non-realisation of the action expressed, as :—

Temiamo che loro non véngano.	*We fear that they will come.*
Temiamo che loro non véngano punto (*or* : affatto, mica).	*We fear that they will not come.*

After 21, 31, etc., the noun is frequently put in the singular.

Note that before **uno** and **otto** the final vowel of **cento** and of all multiples of *ten* is omitted.

Some Common Conversational Phrases

Ha Ella scritto le sue (*or* Sue) léttere ?	*Have you written your letters ?*
Ha detto Lei tutto quello (ciò) che voleva ?	*Have you said all you wish ?*
Loro crédono di sì, ma io credo di no.	*You believe it is so, but I think it is not so.*
Aspetti un momento, La (la) prego !	*Wait a moment, I beg of you.*
Che ne pensa la Signoría vostra (Vostra Eccellenza) ?	*What do you think of it ?*
Ascóltino e dirò loro (Loro) tutto !	*Wait* (pl.), *and I will tell you everything.*
Lor Signori dévono aspettare.	*You must wait.*

VOCABULARY

il capítolo, *chapter.*
preso (préndere), *taken.*
l'abboccamento (*m.*), *interview.*
il contratto, *contract.*
voler dire, *to mean.*
capire, *to understand.*
la rivista, *review, report.*
il riscontro, *reply.*
altrove, *elsewhere.*
conveniente, *suitable.*
la convenienza, *suitability.*
senz'altro, *at once, straight away.*
verso, *towards.*
di consuetúdine, *usually.*
in anticipo, *in advance.*
favorire, *to favour.*
ambito, *desired, esteemed.*
incominciare, *to make a beginning.*
il mezzo, *intermediation* (as agent, etc.).
qualche, *some, any.*
il pareggio, *settlement.*
il provvigione, *commission.*
la metà, *half* (noun).
il feltro, *felt.*
salvo, *except.*
forza maggiore, *circumstances beyond control.*
un terzo, *one third.*

Exercise 29

Translate into English :—

1. Egli ha letto ventun capítolo (*or* : capítoli) ed io ne ho letto ventuno. 2. La vostra léttera del quattro corrente compiegava fattura dell'invío fatto poco fa (di recente) alla nostra casa, nonchè un órdine per seicento pezze di spinati a sette denari (pence) il metro ; sentitamente vi ringraziamo. 3. Prima di entrare in una stanza (cámera), sempre si deve bussare alla porta. 4. Nel partire, hanno detto addío a tutti i loro parenti ed amici e hanno promesso di ritornare tostochè (tosto che) avranno i mezzi per vívere senza lavorare. 5. Dopo di aver scritto a mío padre, ho preso la mía léttera per impostarla e l'ho gettata in una buca vicina. 6. È certo che soffriranno delle pérdite se véndono merci alle case che voi accennate (menzionate). 7. Súbito che l'acqua bolla (pres. subj.), bisogna affrettarvi, poichè preferisco bere il tè caldo caldo. 8. Ci hanno pregati che impostiamo le nostre léttere súbito e che rispondiamo sempre a giro di posta.

Exercise 30

Translate into Italian :—

1. We hope that your friends will find the prices and conditions quite suitable and that they will favour us at once with their esteemed order. 2. On our side we assure you that we have done all we possibly could. 3. How many chapters have you read, thirty or thirty-one ? 4. We hope to have the pleasure of making a beginning, through your good selves (through your valuable intermediation), in the way of putting some transactions through. 5. He refers to his letter of the 8th instant, which enclosed invoice of a new order, together with a cheque in settlement of his account. 6. You need not doubt, therefore, that we shall supply machinery that will leave nothing to be desired in any respect.

Key to Exercise 27

1. Take these letters to the post. 2. Give him my address, if you please. 3. Have the kindness to tell me when I can see you again. 4. Do not believe his tales, they are falsehoods (lies). 5. Look for the nearest letter-box and post this card. 6. When the visitor whom we expect arrives, show him in at once. 7. Finish your work and then you can go away. 8. Do not forget to close the door. 9. Let them say what they like, we shall not go out. 10. Do not allow the employees to smoke during working hours.

Key to Exercise 28

1. (Che) vádano all'avvocato e (che) gli nárrino tutta la storia. 2. Finiamo tutta la nostra corrispondenza prima di andárcene. 3. (Che) lúi scriva loro, spiegando loro tutto l'affare. 4. Parlátemi e dítemi tutto quello che avete fatto. 5. Dátegli da mangiare e da bere. 6. Non andate alla stazione prima di vedermi. 7. Andate súbito dallo stampatore e dítegli che dobbiamo avere la merce fra un'ora. 8. Piacciátevi (*or* Vi prego) di firmare questa léttera e queste cambiali. 9. Fate la fattura e gettátela nella buca più vicina per le létterè. 10. Mío figlio, non pérdere tanto tempo, sii diligente, te ne prego.

A. C.

SPANISH.—XV

Numbers

Cardinal	*Ordinal*
1 uno (m.), una (f) (one)	primero, primera (first)
2 dos (two)	segundo, segunda (second)
3 tres	tercero, -a
4 cuatro	cuarto, -a
5 cinco	quinto
6 seis	sexto
7 siete	sétimo (séptimo)
8 ocho	octavo
9 nueve	nono
10 diez	décimo
11 once	undécimo (décimoprimero)
12 doce	duodécimo
13 trece	décimotercio
14 catorce	décimocuarto
15 quince	décimoquinto
16 diez y seis (dieciséis)	décimosexto
17 diez y siete (diecisiéte)	décimosétimo (décimoséptimo)
18 diez y ocho (dieciocho)	décimoctavo
19 diez y nueve (diecinueve)	décimonono
20 veinte	vigésimo
21 veinte y uno (veintiuno)	vigésimo primero
22 veinte y dos (veintidós)	vigésimo segundo
30 treinta	trigésimo
31 treinta y uno (treintiuno)	trigésimo primero
40 cuarenta	cuadragésimo
50 cincuenta	quincuagésimo
60 sesenta	sexagésimo
70 setenta	septuagésimo
80 ochenta	octogésimo
90 noventa	nonagésimo
100 ciento	centésimo
101 ciento y uno (ciento uno)	centésimo primero
102 ciento y dos (ciento dos)	centésimo segundo
200 doscientos, -as	ducentésimo
300 trescientos, -as	tricentésimo
400 cuatrocientos	cuadringentésimo
500 quinientos	quingentésimo
600 seiscientos	sexcentésimo
700 setecientos	septingentésimo
800 ochocientos	octingentesimo
900 novecientos	noningentésimo
1,000 mil	milésimo
1,000,000 un millón	millonésimo

The days of the month, except the first (el primero), take cardinal numbers, as :—

El 31 (treinta y uno) de julio de 1919, or Julio 31 de 1919, 31*st July*, 1919.

El 1° (primero) de marzo, 1*st March*.

Uno and **primero** (sometimes **tercero**) drop the **o** immediately before a masculine noun singular or its adjective, as :—

El primer fardo.	*The first bale.*
But—	
El primero de los fardos.	*The first of the bales.*
Felipe primero y tercero, reyes de España.	*Philip I. and III., Kings of Spain.*
Un pedazo de pan.	*A piece of bread.*
Uno á uno.	*One by one.*
El tercer (or tercero) libro.	*The third book.*

Ciento drops **to** immediately before a masculine or feminine noun, as :—

Cien piezas.	*A hundred pieces.*
But—	
Ciento cinco piezas.	*A hundred and five pieces.*
Trescientas casas.	*Three hundred houses.*
Cien mil (noun) personas.	*A hundred thousand persons.*
Doscientos mil (as a numeral **mil** has no plural form) hombres.	*Two hundred thousand men.*
Cien millones (noun) de libras esterlinas.	*A hundred million pounds sterling.*

Cardinal numbers are invariable, excepting **uno** and **cientos**, which make in the feminine **una**, **cientas**, as :—

Una caja, cuatrocientas cajas.	*One box, four hundred boxes.*
Quinientas ventanas.	*Five hundred windows.*
Doscientos cincuenta pesos.	*Two hundred and fifty dollars.*
Ciento dos casas.	*A hundred and two houses.*

N.B.—The conjunction **y**, *and*, is generally omitted when, as in the last two examples, zero is the last figure or the last figure but one.

The hours of the day are :—

La una.	*One o'clock.*
Las dos, etc.	*Two o'clock*, etc.
La una y cuarto.	*A quarter past one.*
Las doce menos cuarto.	*A quarter to twelve* (lit., twelve less a quarter)
Las siete y media.	*Half past seven.*
Es la una y diez (minutos).	*It is ten* (minutes) *past one.*

N.B.—**Son las** is used for two o'clock, etc., as **la una** = **una hora** = one hour, and **las dos**, etc. = two hours, etc., therefore plural.

Son las once menos catorce.	*It is fourteen minutes to eleven.*

VOCABULARY

Londres, *London.*	á casa, *home.*
lunes, *Monday.*	la medianoche, *midnight.*
martes, *Tuesday.*	el segundo, *second.*
miércoles, *Wednesday.*	el sol, *sun.*
jueves, *Thursday.*	la puesta del sol, *sunset.*
viernes, *Friday.*	la salida del sol, *sunrise.*

sábado, *Saturday.*
domingo, *Sunday.*
el mes, *month.*
sucesivo, *successive.*
enero, *January.*
febrero, *February.*
marzo, *March.*
abril, *April.*
mayo, *May.*
junio, *June.*
julio, *July.*
agosto, *August.*
setiembre (septiembre), *September.*
octubre, *October.*
noviembre, *November.*
diciembre, *December.*
la estación, *season.*
el nombre, *name.*
la primavera, *spring.*
el otoño, *autumn.*
principiar, *to begin, commence.*
el número, *number.*
cardinal, *cardinal.*
emplear, *to use, employ.*
en lugar de, *instead of.*
ordinal, *ordinal.*
después de, *after.*
después, *afterwards.*
la largura, *length.*
excesivo, *extreme, excessive.*
el teatro, *theatre.*
llamar, *to call.*
la madrugada, *early morning.*
dar, *to strike* (the hour).
es decir, *that is to say.*
el cumpleaños, *birthday.*
marcar, *to mark.*
como, *like.*
el capital, *capital.*
presente, *present.*
al presente, *at present.*
aumentar, *to raise. increase.*
hasta, *to, as far as, until.*
fijar, arreglar, *to fix, arrange.*
la indemnidad, *indemnity.*
remitir, *to remit.*
durante, *during.*
el semestre, *half-year.*
mensualmente, *monthly.*
Jorge, *George.*
el rey, *king.*
el emperador, *emperor.*
la India, *India.*
reinar, *to reign.*
generalmente, *generally.*
preferible, *preferable.*
por motivo de, *on account of.*
pronto, *ready.*
partir, *to leave, depart.*
pedir, *to order.*
el franco, *franc.*

Exercise 27

Translate into English :—

1. Hoy estamos á veinte y uno (veintiuno) de mayo de mil novecientos diez y nueve. 2. Londres, y octubre quince de mil ocho cientos noventa y nueve. 3. Los días de la semana son; lunes, martes, miércoles, jueves, viernes, sábado, domingo. 4. Dígame V. los meses del año. 5. Los meses, en orden sucesivo son : enero, febrero, marzo, abril, mayo, junio, julio, agosto, setiembre (ó septiembre), octubre, noviembre y diciembre. 6. Hay cuatro estaciones en el año. 7. Los nombrès de las estaciones son : la primavera, el verano, el otoño y el invierno. 8. Venga V. á verme á las dos menos cuarto. 9. Es la una y veinte y cinco, debo marcharme. 10. Principiaremos el trabajo á unos minutos antes de las nueve de la mañana. 11. Ahora los números cardinales se emplean casi siempre, en lugar de los ordinales, después del décimo o duodécimo, á lo más. 12. Esto se hace por motivo de la largura excesiva de los números ordinales. 13. Se presentó en mi despacho á las doce menos cinco. 14. Si V. viene aquí á las once y cuarto ó á la una y media, estaré á su entera disposición. 15. Salí del teatro á las once menos veinte y llegué á casa á medianoche. 16. Hay sesenta segundos en un minuto y sesenta minutos en una hora. 17. Después de la puesta del sol hasta medianoche es la noche, y después de medianoche hasta la salida del sol se llama madrugada. 18. Se levantaron á las tres de la madrugada y llegaron á su destino á las ocho y media de la mañana. 19. Cuando den las tres de la tarde, es decir, á tres horas en punto, debe V. estar conmigo. 20. ¿ Á cuantos del mes estamos hoy ? Estamos á nueve, y hoy es mi cumpleaños.

Exercise 28

Translate into Spanish (using words, not figures) :—

1. What day of the month is it to-day ? It is the first of December. 2. The first day is Thursday, and the third day is Saturday. 3. The first of the cases is (está) marked like the first bale. 4. We have ordered a hundred pieces, but you have sent a hundred and five. 5. The capital of the company is a hundred thousand pounds sterling at present, but it will be raised to two hundred thousand pounds. 6. They say that France has received £100,000,000 sterling of the £5,000,000,000 sterling fixed (fem. pl.) as indemnity. 7. We shall remit you £400 each month during the first half-year, and £500 monthly afterwards. 8. Liverpool, November 21, 1920. 9. Please tell me the days of the week and the months of the year. 10. They are : Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday ; and January, February, March, April, May, June, July, August, September, October, November, December. 11. Write me (dat.) the four seasons that there are in the year. 12. George the (omit) Fifth (ordinal), King of England and Emperor of India. 13. Louis XI. (cardinal numeral after ten) reigned over France. 14. After the tenth, cardinal numbers are generally used (tr. use themselves generally) instead of the ordinals. 15. This is preferable on account of the length of the ordinal numbers. 16. Did he present himself at your office before or after twelve o'clock ? 17. Come at a quarter past three in the afternoon. 18. I shall be ready at one o'clock precisely (exactly). 19. I hope to be with you when it strikes one.

Key to Exercise 21

1. I know that you have taken the steps to which you had a right. 2. I am telling you this, so that you may know how to avoid this danger. 3. I go out every day seeking orders, but I do not always have the good luck to obtain them. 4. If I do all that I can, no one will be able to complain of me. 5. If the head of the house dies, that will cause us serious losses. 6. I hear well what they say to me, and it is not necessary for them to repeat anything. 7. You may keep the account uncovered for a time, as I shall not fail to pay it as soon as possible. 8. I wish you to tell me something. How is it that you have left unsettled for such a long time the account of a customer who already owed us such a large amount ? 9. Herewith I am sending you a statement of your account and take the liberty of requesting you to favour me with a remittance, as soon as possible, in settlement of the debt. 10. I am worth as much as he and I do not admit that he should take the lead. 11. I beg to inform (tell) you, Mr. Joseph, that our account has already become an old one, and trust, therefore, that you will have the goodness to remit us immediately part or the whole of the balance. 12. Enclosed I remit you the balance of your account with the respective interest, trusting that we shall remain good friends, as previously.

Key to Exercise 22

1. No se pueden hacer ningunos arreglos con un hombre tan resentido. 2. Este cliente es un hombre muy quisquilloso y es difícil complacerle. 3. Acomódese V. á sus maneras y ya verá V. como se desprenderá de sus pedidos. 4. Aconsejo á V. que le halague y que se acomode á sus maneras de proceder. 5. Les absuelvo á Vs. de toda participación en este asunto. 6. Veo que ha dado V. los pasos á que tenía derecho. 7. Me dice que va á hacer un viaje a España. 8. Cuando yo salgo (buscando) á buscar pedidos, no siempre tengo la felicidad de conseguirlos. 9. El nunca yerra en su juicio de las personas con quienes está tratando. 10. Si yo hago todo lo que puedo para V., estoy seguro que V. hará otro tanto para mí. 11. Siempre hay fiebre en esos parajes y las personas mueren allí cada día.

A. C.

Continued from page 108.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

THE BRITISH ISLES.—I

THE British Isles, forming the United Kingdom of Great Britain and Ireland, consist of an archipelago of about 5,500 islands of various sizes situated upon the north-west extremity of the European continental shelf. They extend from about latitude 50° to 60° North and from longitude 2° East to 10° West.

In the first part of this course it was explained that, generally speaking, the continental shelf is taken as including all that part of the sea whose depth is under 100 fathoms (600 feet). From about this point the bed of the sea usually slopes more or less steeply into the oceanic depths.

Shallow Channels

Now if we take this 100 fathom line as representing the continental shelf, we find that the British Isles are intimately connected with the continent of Europe as represented by the coast of France, the Netherlands and Denmark. Only in the case between the northern portion of the British Isles and Norway is there a deeper depression (the Norwegian Depression). The continental shelf margin, then, sweeps down well to the west of the Shetland and Orkney Islands, the Hebrides, the west coast of Ireland, and does not take an eastward trend until about in the latitude of Brittany, when it passes south-east into the Bay of Biscay. The northern coasts of Spain are almost on the edge of the continental shelf; whereas off the west coast of Ireland—the nearest point of approach of the British Isles to the edge of the continental shelf—there is no place less than 20 to 30 miles distant from it. Off the coast of Cornwall it is over 200 miles distant.

The British Isles are separated from the continent of Europe by various branches of the Atlantic Ocean. Between Great Britain and Scandinavia, Denmark, Germany, Holland and Belgium exists the North Sea. The Strait of Dover and the English Channel separate England from France. Collectively these divisions of the ocean are known as the Narrow Seas. Another branch of the Atlantic Ocean which separates the island of Great Britain from Ireland is known in its various parts as the St. George's Channel, the Irish Sea and the North Channel.

All these waters are shallow and were the land raised by but 300 feet (a height less than that of St. Paul's Cathedral) the whole of the south and east of England and Scotland would be joined by a nearly level plain to the opposite coasts of the Continent, and there would be many passages by which we could walk from England dryshod over to Ireland. So shallow is the Strait of Dover that were St. Paul's Cathedral submerged in the deepest parts the dome would rise in its entirety above the surface of the sea.

Continental Islands

The British Isles, then, form a part of the continent of Europe, of which they are by far the largest islands, and they are essentially of the continental and not of the oceanic type.

The greater part of the smaller islands are situated to the north-west of the archipelago off the coast of Scotland. The largest islands are two in number, one forming the countries of Scotland, England and Wales, or Great Britain, the other that of Ireland. Among the outlying islands those of the largest area are the Isle of Wight in the English Channel; the Isle of Man in the Irish Sea about midway between England, Scotland and Ireland; Anglesey off the coast of North Wales; and the islands of Mull, Skye, Harris and Lewis off the Scottish coast. Included in the British Isles are the Channel Islands of Jersey, Guernsey, etc., situated off the French coast.

The total area of the British Isles is 121,390 square miles, of which the island of Great Britain contains about 88,000. The greatest length of Great Britain from Land's

End to Dunnet Head at the extreme north of Scotland is about 600 miles ; the greatest breadth from Land's End to the North Foreland in Kent is about 330 miles. At two points the island contracts to very narrow dimensions ; between the Solway Firth and the Tyne the breadth is only 60 miles, and between the Firths of the Clyde and the Forth it is only 32 miles. Ireland has an area of 32,605 square miles, 2,700 square miles of this being water and bog-land. The population of the British Isles is about 46 millions.

To understand the physical structure of the British Isles we must consider the geological formation of the country, and the student should read this side by side with the geology course of the present publication. A clear understanding of this part of the subject cannot be obtained without some knowledge of the natural conditions which have obtained in past ages in the building up of any land surface.

Physical Structure

From far back in geological time there have been five periods of uplift which have given the British Isles their present form. The earliest of these created the Huronian Range, the remains of which are seen in the Outer Hebrides running from north-east to south-west. Subsequent to this a period of quiescence elapsed in which vast marine deposits of Cambrian age were laid down. The next period of uplift formed the Caledonian axis, which took place about the end of the Ordovician period. To this upheaval belong the rocks comprising the Highlands of Scotland and the hills of North-West Ireland ; their trend is also in a north-east and south-west direction.

The third and fourth periods of uplift formed the rocks of the southern Scottish uplands, the mountains of the Lake District and Wales, and the heights in Down and Antrim in Ireland. Towards the end of the Carboniferous period occurred the Hercynian movement, which took place in two directions, one from north to south forming the Pennine Chain and the Malvern-Abberley ridge ; and the Armorican ridge extending eastward under the south of Ireland and England into France and Belgium.

It was after this period of uplift that the sandstones, etc., of the Midland plain of England were laid down, a salt lake having been formed in the desert conditions that prevailed from the region where now stand Worcester and Birmingham, branching to the east of the Pennine Chain into Yorkshire, and westward through what is now the Cheshire gap and over to the north-east of Ireland ; a third branch extending towards the Bristol Channel.

At the present time we find that the highest portions of Great Britain are situated on the north and west, and those parts of the country were elevated above the sea level when the southern and south-eastern portions of the island were still beneath the sea. For this reason we find that, speaking generally, as we pass, say, from north-west to south-east on a line drawn from Carnarvon in North Wales through London, we have passed over a succession of rocks representing a complete geological series from the oldest known to the most recent. It is seldom in so small an area that so perfect a geological succession can be found.

Highlands and Lowlands

The difference between the high regions of the border facing the Atlantic Ocean and the low-lying plains of the south-east towards the continent of Europe depends upon this difference of geological structure. Towards the north and west are the hard igneous rocks, and the sedimentary rocks have become indurated or hardened by pressure ; the sandstones becoming compressed into quartzites, the clays into slates, and the limestones which in the south-east are chalky are here crystalline, even becoming marbles in some places. In the south-east, on the contrary, the sandstones are friable and the clays and limestones soft. If, however, we bore down beneath the new and soft rocks of the south-east we come upon hard rocks with all the characteristics and fossils of the old rocks of the western borders.

Considering the physical features more in detail we find that the northern parts of the island of Great Britain that we know as Scotland falls roughly into three divisions : the Highlands, the Central Lowlands, and the Southern Uplands.

The Highlands are composed of ancient igneous and volcanic and metamorphic rocks cut up by deep valleys. The rocks run in bands from north-east to south-west following the lines of ancient uplift as detailed above. Glenmore, a deep valley through which runs the Caledonian Canal, is probably a line of dislocation and divides the Highlands into two parts. To the south-east occurs the Grampian Range, where are situated the highest mountains in the British Isles, several peaks among which may be mentioned : Ben Nevis, Ben Macdhui

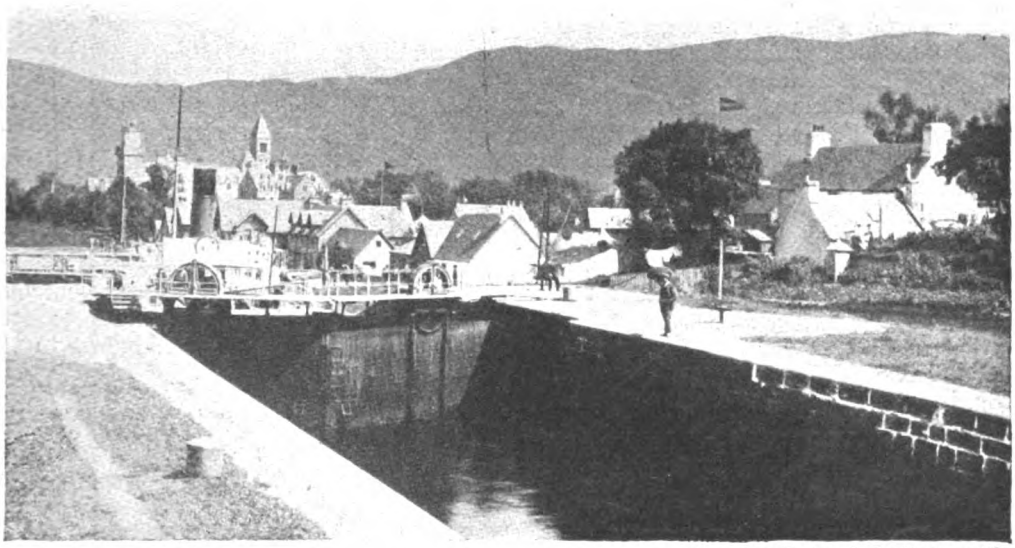


Photo: P. G. Hunt and Co.

The locks of Fort Augustus, on the Caledonian Canal, which runs through the deep valley of Glenmore, a line of dislocation which divides the Highlands into two parts.

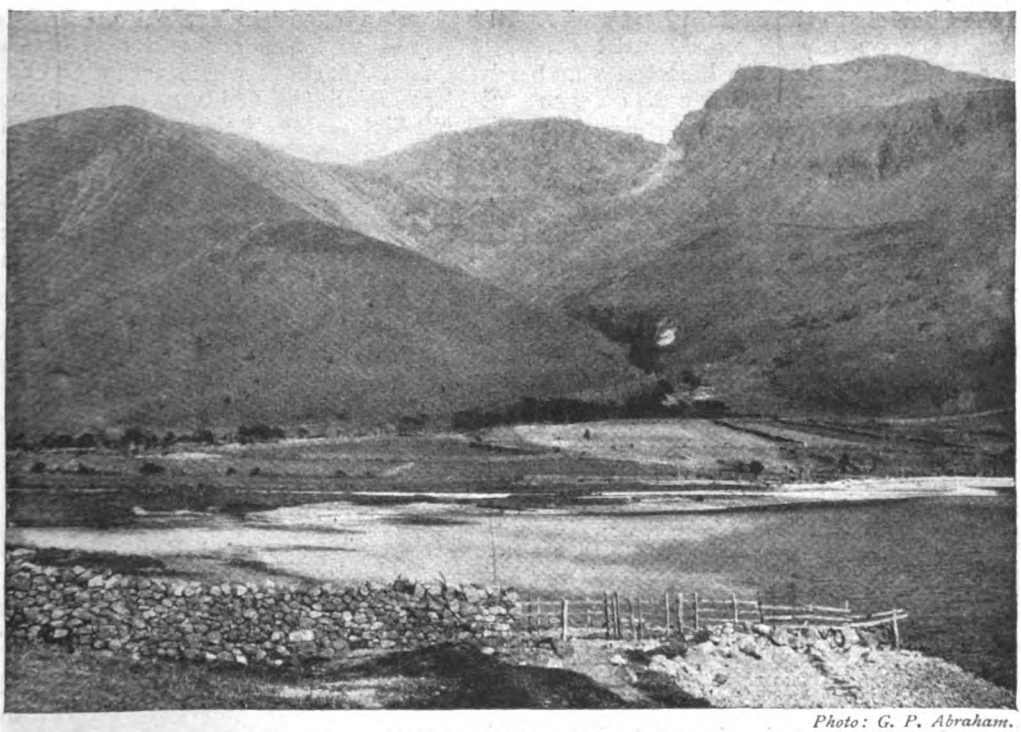


Photo: G. P. Abraham.

In the Lake District: the head of Wastwater, with Scawfell Pike (3,210 feet), the highest mountain in England, in the background.

and Cairntoul, rising above 4,000 feet high.

The Southern Uplands are composed of early stratified rocks of Palæozoic age, mostly Ordovician and Silurian. These hills, for they can hardly be termed mountains, rise to heights not much exceeding 2,500 feet. Between these two is situated the Lowlands, which form what is known as a Rift Valley similar to the rift valleys in Africa. Here the newer rocks have been "let down" between two enormous parallel faults running in a north-east and south-west direction; the northern fault from near Stonehaven in Kincardineshire to the head of the Firth of Clyde at Helensburgh, the southern fault from Dunbar to Girvan in Ayrshire. Between these two faults are found the mesozoic rocks of the Old Red Sandstone and the Carboniferous series, and it is in these latter rocks that the Scottish coal-fields are found.

Scawfell Pike

Passing to the south of the Cheviot Hills, which form the boundary between Scotland and England, we have the median range of hills forming the backbone of the country, known as the Pennine Chain. This runs from the Cheviots to the Peak in Derbyshire, a distance of about 150 miles, and consists of a great arch of Carboniferous limestones and grits with coal measures at intervals on each side. To the west of the Pennines on the north are the mountains of the Lake District, composed of palæozoic and volcanic rocks. These mountains attain an elevation in Scawfell Pike of 3,210 feet, which is the highest mountain in England.

Wales is altogether mountainous, the greatest elevation being reached in the north. The rocks here are of old formations, though in the south are extensive tracts of the Carboniferous series. There are many intrusions of volcanic rocks, among which is one forming the highest mountain in England and Wales, Snowdon, 3,560 feet high. The South Wales hills rise in the Brecknock Beacons to about 2,900 feet.

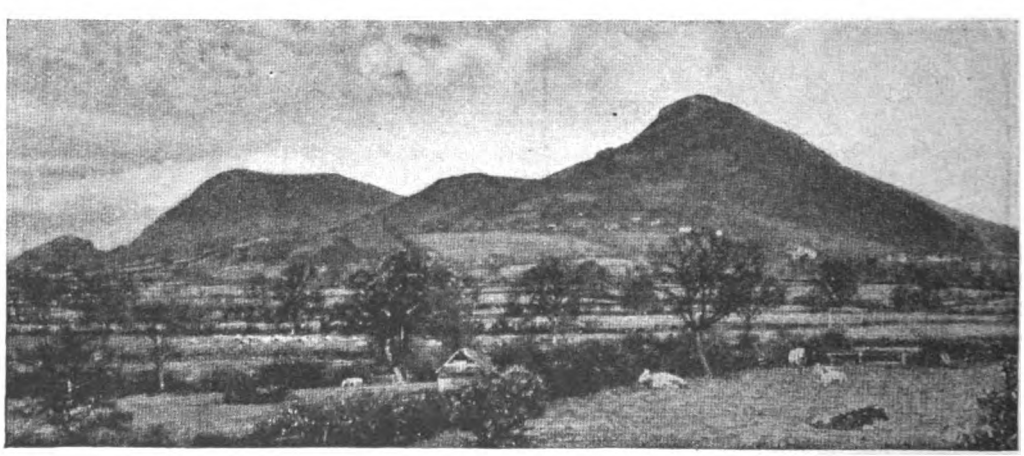
The peninsula of Devon and Cornwall contains the remaining groups of highlands, which consist of elevated tracts of volcanic origin such as Dartmoor and Bodmin moor; and the tableland of Exmoor, which consists of Devonian rocks of the same geological period as the Old Red Sandstone. Yes Tor on Dartmoor, which is the highest in this region, is 2,000 feet high.

The London Basin

To the south and east of these series of uplands occur the plains of Central England, formed of rocks of the Secondary period such as the red sandstones and marls of the Triassic formation. This plain is bounded to the south-east by the escarpment of Oolite rocks which form the Cotswold Hills, etc., and runs in a great curve up to the Cleveland moors in Yorkshire.

South-east of this again is the Jurassic escarpment of chalk which forms the hills of Dorsetshire, the Chiltern Hills and the Lincolnshire and Yorkshire Wolds.

The London Basin is contained in a depression of the Chalk, which rises south of it in the Downs of Surrey, Sussex and Kent. The rocks are of Neozoic formation, and are usually soft sandstones, clays, etc. C. J. S.



THE BREIDDEN HILLS,

in Shropshire, survivals of volcanic activity, are prominent features in the plains of Central England.

Continued from page **114.**

MATHEMATICS:

Contributor: **— ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.**
(M. A. Lewenz, M.A.[Lond.]).

MECHANICS.—XVIII

114. **The Inclined Plane** is the next form of machine we have to consider.

This is used to facilitate the raising of heavy bodies.

A body rests on an inclined plane; to determine the relation between the effort, the weight.

CASE I. Let the effort act parallel to the plane (Fig. 115).

Let A C = l, the length of the plane.
C B = h, the height of the plane.

Then by the principle of work, if the body is moved from A to C,

W × C B = P × A C, i.e. W × h = P × l

$\therefore$ mechanical advantage $= \frac{W}{P} = \frac{l}{h}$

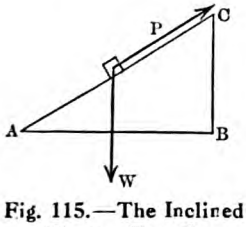


Fig. 115.—The Inclined Plane—Case I.

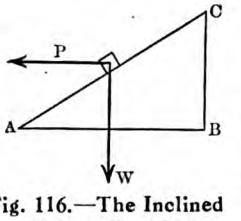


Fig. 116.—The Inclined Plane—Case II.

CASE II. Let the effort act horizontally.

Let A B = b, the base of the plane.
C B = h, the height of the plane.

Then by the principle of work, if the body is moved from A to C,

W × C B = P × A B, i.e. W × h = P × b

$\therefore$ mechanical advantage $= \frac{W}{P} = \frac{b}{h}$.

115. **The Wedge.**

This is a double inclined plane, or triangular block, used for splitting or separating bodies. The wedge we shall consider is isosceles. Examples of the wedge are a knife, a chisel, a chopper.

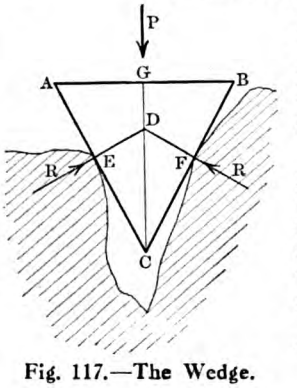


Fig. 117.—The Wedge.

Let a smooth wedge whose section is the isosceles triangle A B C be driven into a body by a force P in the direction G C, i.e. perpendicular to the back of the wedge A B. Suppose the wedge has been driven in a distance = D C (Fig. 117).

Let R be the reaction at the points of contact E and F.

Then the work done by P = P × D C.

Since the points E and F were originally together, the work done against R = R × D E + R × D F = 2 R × D E.

Hence by the principle of work

P × D C = 2 R × D E

$\therefore$ mechanical advantage $= \frac{R}{P} = \frac{D\,C}{2\,D\,E}$.

Now triangles D E C, A G C are similar

$\therefore \frac{D\,C}{D\,E} = \frac{A\,C}{A\,G}$ $\therefore \frac{D\,C}{2\,D\,E} = \frac{A\,C}{2\,A\,G} = \frac{A\,C}{A\,B}$

Hence mechanical advantage $\frac{R}{P}$

$= \frac{\text{length of one of the equal sides}}{\text{back of wedge}}$.

116. **The Screw.**

This consists of a cylinder whose surface carries a **thread,** or has a **groove** in it, which is spiral in its form. It works as a rule in a fixed **collar** or **nut,** and is used to raise weights or overcome resistance at the end of the screw. The collar or nut has a groove or thread to fit the thread or groove of the screw.

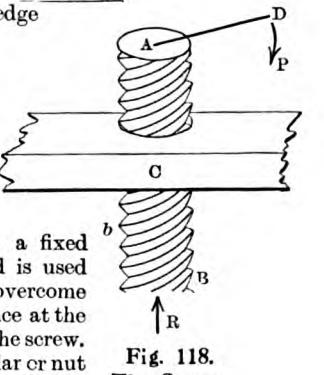


Fig. 118. **The Screw.**

The screw is turned in the collar and moves forward in the direction of its length. For each complete turn the distance moved forward is the distance between two consecutive threads measured along the length of the cylinder or bolt.

This distance is technically called the **pitch** of the screw.

Let A B be the bolt, C the nut, b the pitch and R the resistance. Then the effort P must tend to turn the screw, and must therefore have a moment about A B in a plane perpendicular to A B.

P may therefore be applied at the end of an arm A D (Fig. 118)
or it may be applied at both ends of an arm D A D^1 which projects on both sides as in the screw press (Fig. 119).

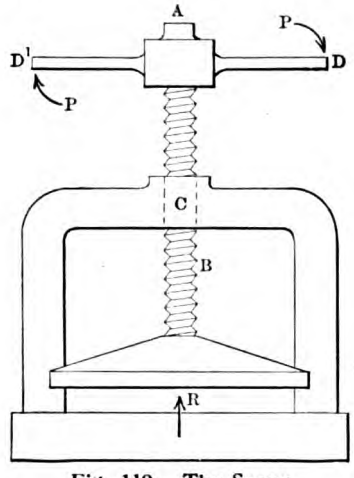


Fig. 119.—The Screw.

Let the length of the arm A D = a.

Then if the screw makes a complete turn, the point of application of P describes a distance $2\pi a$. The screw itself will move through a distance b against R. Hence by the principle of work

$$P \times 2\pi a = R \times b$$

$$\therefore \text{ mechanical advantage} = \frac{R}{P} = \frac{2\pi a}{b}.$$

117. Toothed Wheels.

These are wheels which have teeth that fit into one another and do the work of levers acting continuously. The principle is the same as that of the wheel and axle.

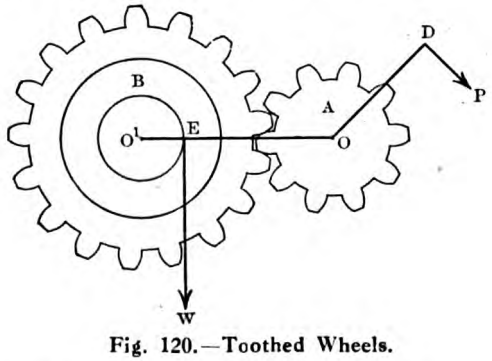


Fig. 120.—Toothed Wheels.

If we have two toothed wheels marked A and B the teeth of which fit exactly into one another, let A be worked by an effort P acting at right angles to a lever at the end D, and let B support a weight $\overline{W}$ on its axis (Fig. 120).

For every complete revolution of B, A will make as many revolutions as the number of times the circumference of B contains the circumference of A.

Let N = number of teeth on circumference of B and n = number of teeth on circumference of A.

Then $\dfrac{\text{circumference of B}}{\text{circumference of A}} = \dfrac{N}{n}$

Hence for one revolution of B, A will make $\dfrac{N}{n}$ revolutions.

For one revolution of B, $\overline{W}$ is moved through a distance equal to the circumference of the axis of B = $2\pi \times O'E$, and for every revolution of A, P moves through a distance $2\pi \times O D$.

Hence by the principle of work

$$\overline{W} \times 2\pi \times O'E = \frac{N}{n} \times P \times 2\pi \times O D$$

$$\therefore \text{ mechanical advantage} = \frac{\overline{W}}{P} = \frac{N}{n} \cdot \frac{O D}{O^1 E}.$$

A similar machine is the rack and pinion (Fig. 121) by which motion in a circle is transformed into motion in a straight line.

118. Differential Wheel and Axle.

In this machine the axle consists of two cylinders with a common axis but having different radii. One end of the rope is wound round one cylinder, the other is wound in a contrary sense round the other, and the slack part of the rope passes round a movable pulley to which the weight is attached.

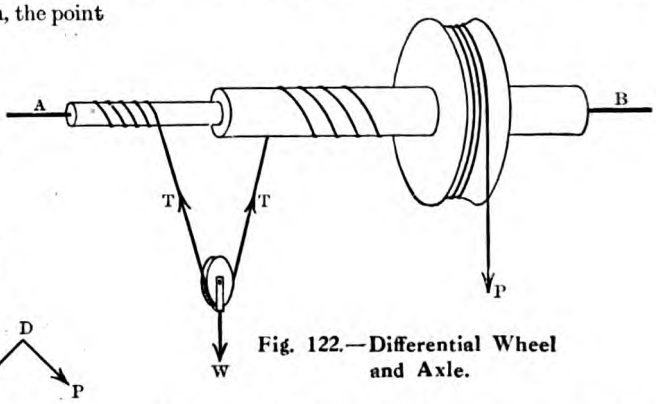


Fig. 122.—Differential Wheel and Axle.

Let a and b be the radii of the larger and smaller portions of the axle and c the radius of the wheel (Fig. 122).

Fig. 121. Rack and Pinion.

Consider a complete revolution of the axle.

A length $2\pi a$ of string is wrapped on to the larger portion, a length $2\pi b$ is unwrapped from the smaller portion, hence the slack part of the string is shortened $2\pi(a - b)$, therefore the weight rises $\pi(a - b)$.

Now in a complete revolution of the wheel the point of application of b moves through $2\pi c$.

Hence by the principle of work

$$\overline{W} \times \pi(a - b) = P \times 2\pi c$$

$$\therefore \text{ mechanical advantage} = \frac{\overline{W}}{P} = \frac{2c}{a - b}.$$

By making the radii of the two parts of the axle nearly equal we can make $a-b$ very small and consequently $\frac{2c}{a-b}$ very large.

119. The Differential Pulley.

In this there are two blocks; the upper contains 2 pulleys nearly equal in size which move as one, the lower contains one pulley to which the weight is attached (Fig. 123).

An endless chain passes round the larger of the upper pulleys, then round the lower, and then round the smaller upper pulley. The rest of the chain hangs slack. The effort P is applied at the slack part hanging from the larger upper pulley.

Let the radius of the larger upper pulley be a.

Let the radius of the smaller upper pulley be b.

In one complete revolution of the upper pulley the length of chain passing over the larger upper pulley $= 2\pi a$, and the length wound over the smaller pulley is $2\pi b$. Therefore the chain connecting the upper and lower pulleys is shortened by $2\pi(a-b)$ and hence W rises through $\pi(a-b)$.

The point of application of P moves through a distance $2\pi a$.

Hence by the principle of work

$W \times \pi(a-b) = P \times 2\pi a$

$\therefore$ mechanical advantage $= \frac{W}{P} = \frac{2a}{a-b}$.

This again can be made very large by making a and b nearly equal.

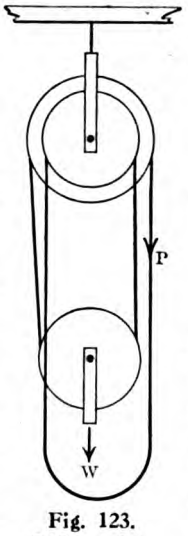


Fig. 123. Differential Pulley.

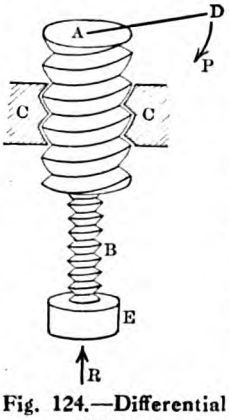


Fig. 124.—Differential Screw.

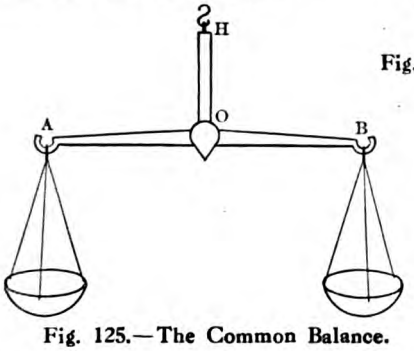


Fig. 125.—The Common Balance.

120. The Differential Screw.

The screw A which is turned by the lever A D works in the nut or collar C. The inside of A is hollow and is grooved to fit a smaller screw B which is fixed to a block E so that it cannot rotate but can only move in the direction of its length. Let the length of A D be a, the pitch of A be equal to b, and the pitch of B equal to c, where c is slightly smaller than b.

In one revolution the point of application of P moves a distance $2\pi a$.

In one revolution the screw A travels down a distance b and the screw B penetrates a distance C into A. Hence the block E is forced down a distance $b-c$.

By the principle of work

$R \times (b-c) = P \times 2\pi a$

$\therefore$ mechanical advantage $= \frac{R}{P} = \frac{2\pi a}{b-c}$

and this can be made very great by making C very nearly equal to b.

Balances.

121. The Common Balance.

This consists essentially of a rigid beam A B, carrying a scale pan suspended at each end, which can turn freely about a fulcrum O outside the beam.

The fulcrum and the beam are rigidly connected, and in a good balance at the point O a hard steel wedge, with its edge turned downwards, rests on a plate of agate or of steel. Such a wedge-shaped piece of steel is called a **knife edge** (Fig. 125).

The body to be weighed is placed in one pan and weights of known magnitude are placed in the other. These weights are diminished or increased until the beam of the balance rests in a horizontal position.

A balance must be (i) **true**, (ii) **sensitive**, (iii) **stable**.

(i) The balance will be **true** if the arms of the beam are of equal length, the scale pans of equal weight and the centre of gravity of the beam on the line through the fulcrum perpendicular to the beam; in this case the beam will be horizontal when equal weights are placed in the scale pans.

(ii) If the balance is **sensitive**, then if there be the slightest difference between the weights in the two scale pans, the beam must be inclined at an appreciable angle to the horizontal.

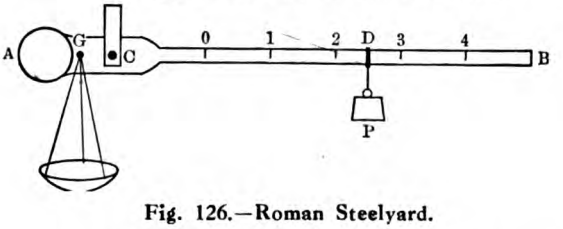


Fig. 126.—Roman Steelyard.

(iii) If the balance is **stable** it will quickly take up its position of equilibrium.

122. Double Weighing.

By this means the weight of a body may be accurately determined even with a faulty balance. Place the body in one scale pan and place in the other sufficient sand or small shot to balance it. Then remove the body and in its place put known weights sufficient again to balance the sand. The weight of the body clearly equals the sum of the known weights.

123. The Common or Roman Steelyard.

This consists of a rod A B movable about a fixed fulcrum at C, fixed near the end A (Fig. 126).

From A is suspended the scale pan containing the body to be weighed, and a movable weight P is made to slide along the arm C B until the rod balances horizontally. The arm C B is graduated so that P shows the weight of the body.

To graduate the steelyard.

First let the pan be empty and let O be the position of P when the rod balances horizontally about C. The point O is marked zero.

Now place a known weight $\overline{W}$ in the pan; this weight has a moment $\overline{W} \times A C$ about C. To balance this we move P along in the direction O B to increase its moment about C, when the rod balances horizontally if P is at the point D.

Now the moment of P has been increased by $P \times C D - P \times C O = P \times O D$, hence equating the moments of P and $\overline{W}$ about C we have

$$P \times O D = \overline{W} \times A C$$

$$\therefore O D = \frac{\overline{W}}{P} \times A C.$$

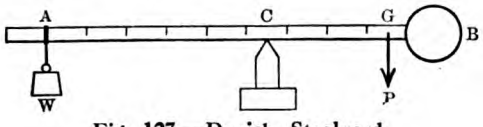


Fig. 127.—Danish Steelyard.

Now let 1 indicate the position of P when 1 lb. is placed in the scale pan.

Then $O 1 = \frac{1}{P} \times A C \therefore O D = \overline{W} = O 1$

Hence if $\overline{W} = 2$ lb. then $O D = 2 \times O 1$.

Hence we discover by actual experiment the points O and 1 at which P must be placed when the scale pan is empty or contains a weight of 1 lb. respectively. Then from O we measure off multiples and submultiples of O 1.

124. The Danish Steelyard.

This consists of a bar A B ending in a heavy ball B, while the body to be weighed is suspended at A (Fig. 127).

The weight of the body is determined by noting about what point C on the bar the whole balances.

To graduate the Danish steelyard.

Let P be the weight of the steelyard and scale pan and G the centre of gravity.

Let C be the point about which the whole balances when a weight $\overline{W}$ is placed in the scale pan.

Taking moments about C

$$\overline{W} \times A C = P \times C G = P \times (A G - A C)$$

$$\therefore A C \times (P + \overline{W}) = P \times A G$$

$$\therefore A C = \frac{P}{P + \overline{W}} \times A G.$$

Take $\overline{W} = P$; then $A C = \frac{1}{2} A G$, i.e. C is the middle point of A G. This middle point we mark 1.

Next take $\overline{W} = 2P$; then $A C = \frac{1}{3} A G$. This position we mark 2.

Proceeding thus we find the position of C when $\overline{W} = 2P, 3P, 4P$, etc.

M. A. L.

MENSURATION.—I

1. **Mensuration** deals with the determination of lengths, areas and volumes of figures. It will be assumed that the student is familiar with a certain amount of Arithmetic, Geometry, Algebra and Trigonometry. Definitions given in the courses on the above subjects will not be repeated, and results arrived at in them will, as a rule, be quoted without proof.

2. Mensuration of the surface of rectilineal figures.

The **unit of area** is a square, the side of which is of unit length.

The **area** of a surface is measured by the number of such units which it contains.

3. *To find the area of a rectangle.*

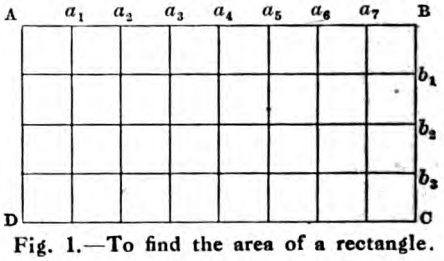


Fig. 1.—To find the area of a rectangle.

Let A B C D be a rectangle and let the sides A B, B C contain a units of length and b units of length respectively.

Along A B mark off Aa_1, a_1a_2, a_2a_3, etc., each equal to one unit of length, and along B C mark off Bb_1, b_1b_2, b_2b_3, etc., each equal to one unit of length.

Through a_1, a_2, a_3 . . . draw lines parallel to B C and through b_1, b_2, b_3 . . . draw lines parallel to A B.

Since A B contains a units of length, the area of the rectangle Ab_1 is a times the area of the square whose side contains one unit of length, therefore the rect. $Ab_1 = a$ units of area.

But since B C contains b units of length, the area of the rect. A B C D is b times the area of the rect. Ab_1.

Hence area of rect. A B C D

$= b \times$ area of rect. Ab_1

$= b \times a$ units of area

$= ab$ units of area.

Thus **the area of a rectangle is the product of the number of units of length in two adjacent sides.**

4. *To find the area of a parallelogram.*

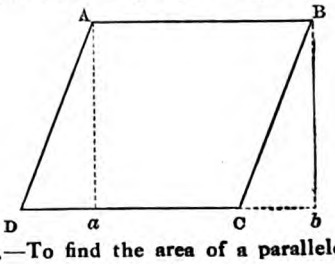


Fig. 2.—To find the area of a parallelogram.

Let A B C D be the parallelogram.

Through A and B draw perpendiculars Aa and Bb to the base C D.

Then A B b a is a rectangle on the same base A B and between the same parallels A B, D b as the parallelogram A B C D.

∴ **area of A B C D**
= area of A B b a = A B × B b
= **base of parallelogram × height.**

Again, let the length of A B = a, and the length of A D = b, and the angle A D C = δ.

Then **area of A B C D** = A B × Aa
= A B × A D sin δ
= $a \times b$ **sin** δ.

5. *To find the area of a triangle.*

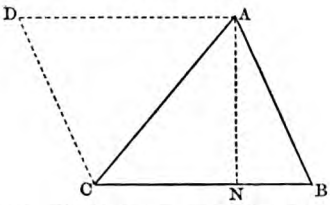


Fig. 3.—To find the area of a triangle.

Let A B C be the triangle. Complete the parallelogram A B C D and draw A N perpendicular to B C.

Since A C is a diagonal of the parallelogram, it bisects it

∴ **area of △ A B C**
= ½ area of A B C D
= ½ B C × A N
= ½ **base of triangle × height.**

Again, let A B C be a triangle and draw A N perpendicular to B C produced if necessary (Figs. 4 and 5).

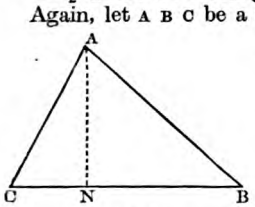


Fig. 4.

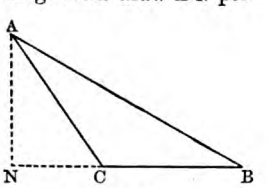


Fig. 5.

Then area of △ A B C = ½ B C × A N.

But A N = A B sin B.

∴ area of △ A B C = ½ B C × A B sin B or indicating the sides by small letters corresponding to the angles which they subtend,

area of △ A B C = ½ ac sin B.

It is worth noting some particular cases.

(i) If B be a right angle, since sin 90° = 1, area of △ A B C = ½ a c.

(ii) If the triangle be equilateral and the length of each side = a, then B = 60° and since sin 60° = $\frac{\sqrt{3}}{2}$

area of $\triangle$ A B C = $\frac{1}{2} \times a \times a \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4} a^2$

Lastly since sin B = $\frac{2}{ca} \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

Where $2s = a + b + c$

Area of △ A B C = ½ ac sin B *
= $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

* See courses on Geometry and Trigonometry.

6. A **trapezoid** is a four-sided figure having two of its sides parallel.

To find the area of a trapezoid.

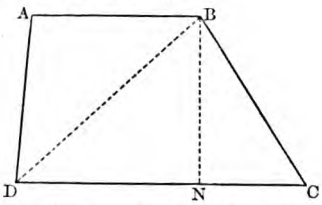


Fig. 6.—To find the area of a trapezoid.

Let A B C D be a trapezoid having the sides A B, C D parallel.

Join B D and draw B N perpendicular to C D.

Then area of A B C D
= area of △ A B D and area of △ B C D.

Now, since A B, C D are parallel the height of triangles A B D, C B D is the same, i.e. it is B N

∴ **area of A B C D** = ½ A B × B N + ½ C D × B N
= ½ B N (A B + C D)
= ½ **height × (sum of parallel sides).**

7. *To find the area of a rhombus.*

Let A B C D be a rhombus, and let its diagonals A C, B D intersect at O (Fig. 7).

Area of A B C D = sum of areas of △s A B C, C D A.

Now the diagonals of a rhombus intersect at right angles.

∴ **area of A B C D**
= ½ × A C × B O + ½ × A C × O D
= ½ A C (B O + O D) = ½ A C, B D
= **half the product of the diagonals.**

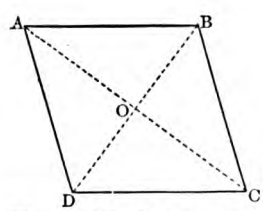


Fig. 7.—To find the area of a rhombus.

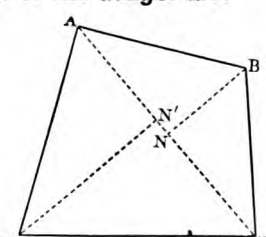


Fig. 8.—To find the area of a quadrilateral.

8. *To find the area of a quadrilateral.*

Let A B C D be the quadrilateral (Fig. 8).

Draw the diagonal A C and draw B N, D N′ perpendicular to A C.

Then area of A B C D
= sum of areas of △s A B C, C D A
= ½ A C × B N + ½ A C × D N′
= ½ **A C (B N + D N′).**

Again let a, b, c, d represent the length of the sides A B, B C, C D, D A.

Let < B = $\omega + \beta$ and < D = $\omega - \beta$.

Then area of A B C D
= sum of areas of △s A B C, C D A.
= ½ a b sin B + ½ c d sin D
= ½ a b sin $(\omega + \beta)$ + ½ c d sin $(\omega - \beta)$

Suppose the area of A B C D = P.

Then 2 P = $(ab + cd)$ cos β sin ω − $(cd - ab)$ sin β cos ω (i)

Also $A^2 = A^2 + b^2 - 2ab \cos(\omega + \beta)$
$= c^2 + d^2 - 2cd \cos(\omega - \beta)$
$\therefore \frac{1}{2}(c^2 + d^2 - a^2 - b^2)$
$= (cd - ab) \cos\beta \cos\omega + (ab + cd) \sin\beta \sin\omega$ (ii)

Squaring (i) and (ii) and adding, we have by eliminating β, $4P^2 + \frac{1}{4}(c^2 + d^2 - a^2 - b^2)^2$
$= (ab + cd)^2 \sin^2\omega + (cd - ab)^2 \cos^2\omega$
$\therefore 4P^2 = a^2b^2 + c^2d^2 - 2abcd(2\cos^2\omega - 1)$
$- \frac{1}{4}(c^2 + d^2 - a^2 - b^2)^2$
$\therefore 16P^2 = 4(ab + cd)^2 - (c^2 + d^2 - a^2 - b^2)^2$
$- 16abcd \cos^2\omega$
$= (2ab + 2cd + c^2 + d^2 - a^2 - b^2) \times$
$(2ab + 2cd - c^2 - d^2 + a^2 + b^2) - 16abcd \cos^2\omega$
$= (c + d + a - b)(c + d - a + b) \times$
$(a + b + c - d)(a + b - c + d) - 16abcd \cos^2\omega$

Now let $2s = a + b + c + d$, then
$16P^2 = 16(s - a)(s - b)(s - c)(s - d)$
$- 16abcd \cos^2\omega$
$\therefore P$
$= \sqrt{(s-a)(s-b)(s-c)(s-d) - abcd\cos^2\omega}$

Now $\omega = \frac{1}{2}$ sum of angles B and D.

Hence we have expressed the area of a quadrilateral in terms of the sides and the sum of two opposite angles.

If the quadrilateral be cyclic, i.e. inscribed in a circle, then $B + D = \pi$

$\therefore \omega = \frac{\pi}{2}$ $\therefore \cos\omega = 0$, and in that case

$$P = \sqrt{(s-a)(s-b)(s-c)(s-d)}$$

It follows that **given the lengths of the sides of a quadrilateral, the area is greatest when the quadrilateral can be inscribed in a circle.**

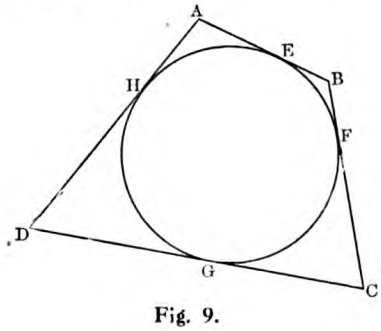


Fig. 9.

Again, suppose the quadrilateral A B C D be described about a circle and touch it at E, F, G and H (Fig. 9).

Then, since A E = A H, B E = B F, C F = C G and D G = D H
$2s = 2(AH + HD + BF + FC) = 2(AE + EB + CG + GD) = 2(d + b) = 2(a + c)$
$\therefore s = b + d = a + c$
$\therefore s - a = c, s - b = d, s - c = a, s - d = b$
Hence **area P**
$= \sqrt{abcd - abcd\cos^2 w} = \sqrt{abcd\sin^2 w}$
$= \sqrt{abcd}\ \sin\omega$

9. *To find the area of an irregular polygon.*

Any irregular polygon can be divided into triangles as in the figure, and by measuring the lengths of the lines A C, A D, A E, A F and also the lengths of the perpendiculars on them from B, C D and E respectively, the areas of all the various triangles which go to make up the polygon can be calculated (Fig. 10).

The area of the polygon is the sum of the areas of the triangles.

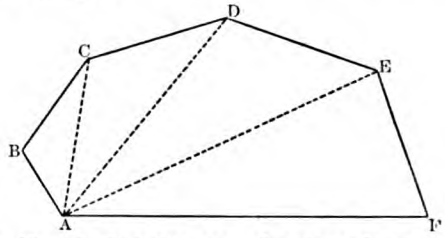


Fig. 10.—To find the area of an irregular polygon.

Or again the polygon may be reduced to a triangle of equal area in the following way.

Let A B C D E be a pentagon (Fig. 11).

Join C A, C E and through B and D draw lines B F, D G parallel to C A, C E respectively and cutting

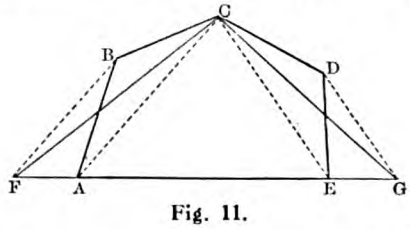


Fig. 11.

A E produced in either direction at F and G. Join C F, C G.

Then since
area of $\triangle$ A C F = area of $\triangle$ A C B
and area of $\triangle$ E C G = area of $\triangle$ E C D
therefore area of $\triangle$ F C G = area of fig. A B C D E.

By repeated application of this process a polygon of any number of sides may be reduced to a triangle which equals it in area. By measuring the base and height of the resulting triangle, the area may be found.

10. *To find the perimeter and area of a regular polygon inscribed in a circle.*

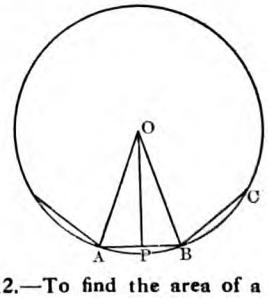


Fig. 12.—To find the area of a regular polygon inscribed in a circle.

Let A B C . . . . be a regular polygon of n sides inscribed in a circle of centre O and radius r.

Join O A, O B. Then $\angle$ A O B $= \frac{2\pi}{n}$

Area of polygon
$= n \times$ area of $\triangle$ A O B

$= n \times \frac{1}{2}$ A O. O B sin A O B

$= \frac{1}{2}\ nr^2 \sin \frac{2\pi}{n}$.

Draw O P perpendicular to A B

Then $\angle$ A O P $= \frac{1}{2} \times \frac{2\pi}{n} = \frac{\pi}{n}$

and A P $= \frac{1}{2}$ A B.

Perimeter of polygon

$= n \times$ A B $= 2n \times$ A B

$= 2n \times$ A O sin A O B

$= \mathbf{2\ nr \sin \frac{\pi}{n}}$.

11. *To find the perimeter and area of a regular polygon described about a circle.*

Let A B C . . . . be a regular polygon of n sides described about a circle of centre O and radius r.

Let P be the point where A B touches the circle.

Join O A, O B, O P. Then $\angle$ A O P $= \frac{\pi}{n}$.

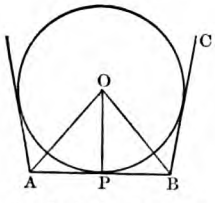


Fig. 13.—To find the area of a regular polygon described about a circle.

Area of polygon

$=$ $n \times$ area of $\triangle$ A O B

$= n \times$ O P $\times$ A P

$= n \times r \times r \tan \frac{\pi}{n}$

$= \mathbf{n\ r^2 \tan \frac{\pi}{n}}$.

Perimeter of polygon

$= n \times$ A B $= 2n \times$ A P

$= \mathbf{2\ n\ r \tan \frac{\pi}{n}}$.

12. Examples :—

(1) The length of one side of a rectangular field is 319 yds. ; its area is 18 acres 20 poles.

Find the length of the other side.

Let x be the required length in yards.

Then $319 \times x$ sq. yds. $= 18$ ac. 20 po. $= 87725$ sq. yds.

$\therefore\ x = \frac{87725}{319}$ yds.

$= \mathbf{275\ yds.}$

(2) Find the area of a triangle whose base is 24 ft. and whose altitude is 3 yds.

Let x = area of $\triangle$ in sq. ft.

Then $x = \frac{1}{2} \times 24 \times 3 \times 3$ sq. ft.

$= 108$ sq. ft.

$= \mathbf{12\ sq.\ yds.}$

(3) Find the area of a triangle whose vertical angle $= 45°$ and whose sides containing the vertical angle are 6 in. and 8 in respectively.

Let x = area of $\triangle$ in sq. in.

Then $x = \frac{1}{2} \times 6 \times 8 \times \sin 45° = \frac{1}{2} \times 6 \times 8 \times \frac{1}{\sqrt{2}}$

$= \frac{24}{\sqrt{2}} = \mathbf{12\ \sqrt{2}\ sq.\ in.}$

(4) Find the area of a triangle whose sides are 10, 12 and 20 in. respectively.

Hence $2s = 10 + 12 + 20 = 42\ \therefore\ s = 21$

$s - a = 11,\ s - b = 9,\ s - c = 1$

Let x = area of $\triangle$ in sq. in.

Then $x = \sqrt{21 \times 11 \times 9 \times 1} = 3\sqrt{231} =$ **45·6 sq. in. nearly.**

(5) Find the area of a regular hexagon inscribed in a circle of radius 8 ft.

The angle subtended at the centre by one side $= \frac{360°}{6} = 60°$

Let x = area of hexagon in sq. ft.

Then $x = \frac{1}{2} \times 6 \times 8^2 \times \sin 60° = 192 \times \frac{\sqrt{3}}{2}$

$= \mathbf{96\ \sqrt{3}\ sq.\ in.}$

Exercise 1

Find the area of the rectangles whose length and breadth are :

(1) 25 yds., 17 yds. (2) 17 ft. 3 in., 13 ft. 10 in. (3) 90 yds., 60 yds. 1 ft. 6 in.

(4) The area of a rectangular field is 1 acre 1 rd. 10 po., and its one side is $82\frac{1}{2}$ yds. long. Find the length of the other side.

(5) The area of a courtyard is 92 sq. yds. 4 sq. ft., and one side is 26 ft. long. Find the length of the other side.

(6) The area of a square field is 10 acres. What is the length of its side ?

(7) Find the area of the parallelograms whose bases and heights are :

(i) 12 ft. and 6 ft. (ii) 14 ft. and $5\frac{1}{2}$ ft. (iii) 3 ft. and 27 in.

(8) Find the area of the parallelograms whose sides and included angle are :

(i) 12 in. ; 18 in. ; 30°. (ii) $(a + b)$; $(a - b)$; 45°. (iii) 22 yards ; 64 yds. ; 120°.

(9) How many yds. of carpet $\frac{1}{2}$ yd. wide will cover a room 40 ft. 8 in. by 24 ft. 6 in. ?

(10) How many paving stones 1 ft. long and $\frac{4}{5}$ ft. wide will it take to pave a street 45 ft. wide surrounding a square the side of which is 225 ft. ?

(11) Find the area of a triangle whose base is 3 ft. and whose height is 22 in.

(12) Find the area of a triangle two adjacent sides of which are $(a + b)$ and $(a - b)$ respectively, and the angle they contain 30°.

(13) Prove that, if A be the vertical angle of an isosceles triangle, its area $= \frac{\sin 2c}{32 \cos^4 \frac{c}{2}} (2c + a)^2$.

(14) The area of a triangle of base 25 in. and height 40 in. equals the area of a parallelogram of base 20 in. Find the height of the parallelogram.

(15) Find the area of a trapezoid whose parallel sides measure 10 in. and 16 in. respectively and whose height is 5 in.

(16) The area of a rhombus is 72 sq. ft. The length of one diagonal is 18 ft. What is the length of the other diagonal ?

(17) Find the area of a dodecagon inscribed in a circle of radius 5 in.

(18) Find the difference between the areas and perimeters of regular hexagons inscribed in and described about a circle of radius 8 ft. M. A. L.

Continued from page 116.

ART AND MUSIC:

Contributors:—THE THEORY OF ART (Hon. John Collier; J. G. B. Lynch). DRAWING AND PAINTING (J. G. B. Lynch). THE THEORY OF MUSIC (R. R. Terry, Mus.Doc., F.R.C.O.; Hubert Grant).

SKETCHING FROM NATURE.—III

HAVING experimented from your reading of the lesson on p. 115, you should now take an object which has all its sides retiring, that is to say, presenting an angle to you. Here you must be governed entirely by the rules of angular perspective, and for this purpose it will be as well to refer to the lessons that have gone before dealing with that subject. A house in parallel perspective can have but one position; but when you have a house in angular perspective it may be in one of many different positions. This depends on the angle of inclination which the side of the house forms either with your position or with the picture plane.

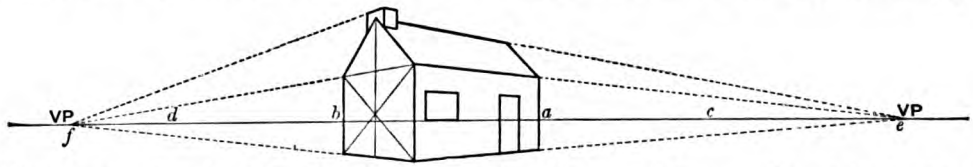


Fig. 93.—Showing the value of a simple application of geometrical perspective when sketching from Nature.

Before going farther you should now carefully study the relation between the actual object you are going to draw and your picture. The most important point to understand is that which concerns your position as mentioned above in relation to the angle of the house. The whole of angular perspective as applied to sketching from Nature depends on this. The final test of accuracy in your drawing may be made in the following manner. Hold up your picture, so that the light strikes through it, against the object. Each line in the picture should then correspond precisely with each line in the object, gate for gate, wall for wall. Of course, to achieve this means very perfect drawing. It is an ambition to work forward to.

With regard to your position: you sit on an imaginary line which runs straightly left and right of you and look straight before you at the object. Therefore your position is at right angles with the object. If you trace the lines of the object upon a piece of glass held straight before you, the surface of the glass will be the picture plane and its position will be parallel to your position. Every vertical line in the object will necessarily be vertical in your picture: and in the same way every line which forms an angle with your position will also form an angle with your glass or picture, *because* it is parallel with the position. If then a line in the landscape, or whatever it is you are drawing, is so placed that each end is equidistant from the picture plane, and therefore parallel with it, all you have to do is to draw your line straight across the picture. There is no question then of perspective. There is no vanishing point. But when one end of a line is nearer to the eye than the other, then the line is a retiring line and lies at an angle both with your position and the picture plane. And all such lines as this have vanishing points. It is necessary to say this much in order to demonstrate the process of drawing retiring lines from nature.

You should bear in mind the geometrical rule for finding the vanishing point (V.P.): "*Draw a line from the station point parallel to the ground plane as far as the picture plane.*" This rule will help you wherever you wish to discover the V.P. for the retiring lines of walls, houses, or whatever objects may be before you. Geometrical perspective is of inestimable value in drawing from Nature. With a little practice in it behind you, you have confidence where anyone without that practical knowledge would hesitate and so spoil a line. If you are doubtful about the proportions of any whole object or any part of it, you have only to search through your experience of geometrical perspective and the answer will readily come to you.

Take your stand before your object, and hold up your arm horizontally and parallel with the retiring side of the house you are observing. Let your eye follow your arm, and you will see that you are

pointing directly at the V.P. A useful point to remember here is that when drawing from Nature you can generally fix the V.P. by some house or tree or other object in the distance. This will be of great help to you. Now hold up your pencil at the full extent of your arm; let it be horizontal between your eye and the house you are drawing. Measure its length with the pencil and observe how many pencil lengths are required to reach from the plane (or with your position), they would meet the horizontal line at a point some distance out of the picture: so that the V.P. could not be placed on the paper. Therefore you should hold the pencil horizontally between your eye and the roof, like the line *b c*, by which you discover the proportion of the inclination.

It is impossible to give a full explanation in print of that that you see in sketching from Nature. You

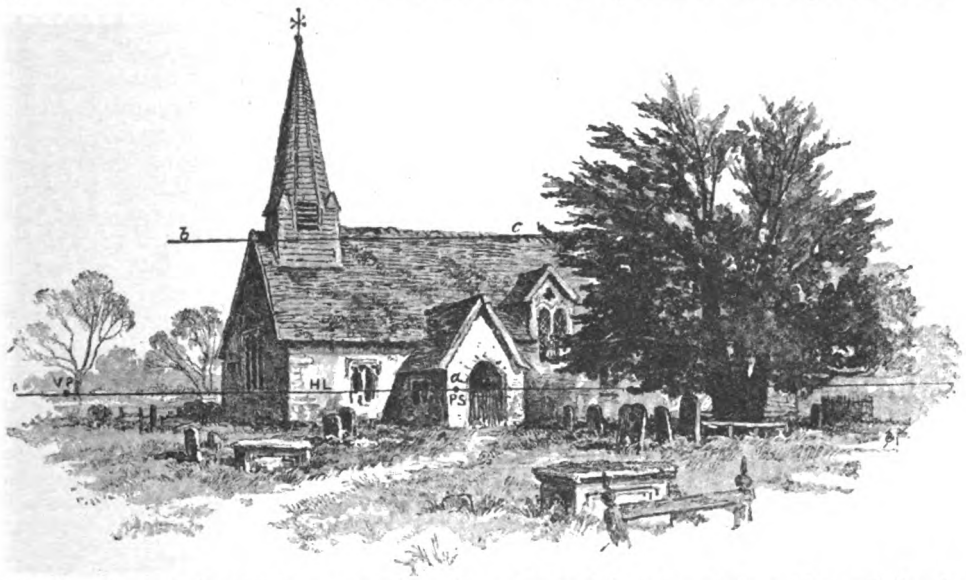


Fig. 94.—A study in angular perspective. In order to bring the whole subject within the angle of vision (i.e. 60°) the point of sight must be at *a*.

end of the house to the V.P. Take it, for the sake of argument, that two lengths are required. You then draw the horizontal line and next decide upon the size of the house, or the space you mean it to take up in your drawing. We will say from *a* to *b* (see Fig. 93); repeat that space twice over along the horizontal line, from *a* to *c*, and then from *c* to *e*, which will then be the V.P. for all parallel and horizontal retiring lines upon that, the right hand, side. The same process governs the retiring end of the house. If you stand farther away from the house, then the measured length will have to be repeated oftener in order to reach the vanishing point.

Now study Fig. 94, a drawing of a church. Sit near it and you will see that the point of sight must be at *a* in order to bring the whole subject within the angle of vision, which is sixty degrees. Hence you will have to treat it by angular perspective. If you sat farther away you could have used parallel perspective, and then the vanishing point together with the point of sight would have been fixed at the end of the building. However, sitting close, you hold out your arm parallel to the end of the building. You will then point to and find the V.P. at the tree which is marked. This as a matter of fact would also be the V.P. for the parallel retiring lines of the porch. The ridge of the roof and all lines parallel with it would retire in the other direction, but being at a very small angle with the picture

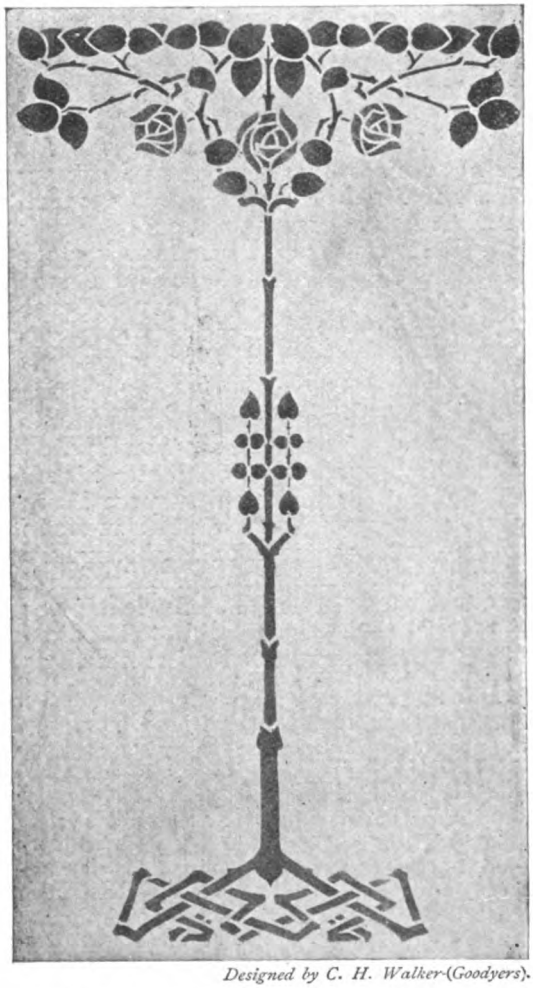
must keep your knowledge of geometrical perspective at hand, ready always to be drawn upon. Otherwise, there is really nothing that will help you. If, as some people maintain, the eye and the eye alone is what you should train and be dependent on, there is nothing more to be said. But it is not so. There is no single line in any conceivable object which you can possibly be called upon to draw which has not some rule governing its representation. If you do not use that rule to place the line rightly, you will find only how bad your mistakes can be by applying the same rule as a test afterwards.

So much must be said with regard to the skeleton work of Nature sketching. It is absolutely necessary to master these principles which you may aptly describe as the grammar of sketching. But having mastered them they should be subconsciously at the back of your brain, ready to be drawn upon as required. They do not provide the soul of your work. Inspiration must come from you and you alone, though inspiration without technical knowledge is wasted. Always remember that rules treating of the grammar of art can be taught, and a certain amount of theory can be taught also. But that which makes a picture good to look at, that which differentiates art from a mere exposition of technical rules cannot be taught at all. That is purely personal. It entirely depends upon your own expression.

J. G. B. L.

STENCILLING IN COLOUR

THERE are many contrivances which even the veriest student in art can employ for his own amusement, and one of these is the cutting of stencils. By this is meant the process by which you may become your own colour-printing-press.



Designed by C. H. Walker (Goodyers).

A PANEL OF A STENCILLED FRIEZE,

The outline of which is printed from a key-block, and the tinting applied afterwards.

First of all draw your design on good thick drawing-paper, then tint it with water colour. All outlines must be quite clear and distinct. Choose only three colours, including the paper on which the stencil will be made. That can always be tinted if you wish to avoid white altogether, and to take one instance at random, you could not have a more charming combination than a slightly softened burnt sienna and black upon a biscuit-coloured ground. When you have drawn your full design you should take a singularly sharp penknife and cut out all those parts which are to be of the reddish colour. In making your design try to let the outline of various objects form the straps which tie one piece of the picture to another. Straps which are not in any way part of the picture tend to spoil it if they are repeated over and over again.

Next, make a tracing, and on an exactly similar piece of paper draw and cut out the black bits. Take the utmost pains to see that the parts correspond in the two sheets. The paper or card upon which you will stencil the design should be of the same size and shape, of course, and fastened securely to a drawing-board with the others in turn fixed over it. Put on the colour through No. 1 design first and then after it is well dried, through No. 2. The colour should be put on with a stubbly brush which can be procured for that purpose. Some people recommend oil colour. In any case you must get the colour as dry as possible. Sometimes it is necessary to fortify the cut drawing-paper by allowing a thin coating of glue to dry upon the underside. As a method of decorating rooms papered with plain—particularly white—paper, stencilling is admirable.

Stencil-Cutting

If large stencils are required and are frequently used, the best plan is to cut them out of thin sheet brass. Brass is very easily cut, and if you find your drawing-line thereon difficult to see, you can always allow a little whitish paint to dry upon it first before using a pencil. A blunt chisel or wire-scissors—or the combined use of both alternately, is the best means for the accurate cutting of your design from brass.

Stencil-cutting requires a good deal of ingenuity, especially when you come to do intricate designs. But as in all things it is better to begin simply with letters, and when you have once made the mistake of cutting out an O completely, forgetting the straps which must tie it to the main bulk of the paper, you are not likely to repeat it.

In doing black and white drawings for reproduction, say that you wish to get the effect of a background of shadow: cut out a shield of paper which covers all your drawing except the part so to be treated: then take an old nailbrush dipped in Indian ink and, using both hands, flick the ink in myriads of little blots upon the exposed parts.

J. G. B. L.

Continued from page 122.

BUSINESS AND COMMERCE:

Contributors:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).

COMMERCIAL TRAINING.—XXXVII

THE object of National Health Insurance is to arrange by legislative measures that all who are employed at wages below a fixed standard shall make some provision for times of ill-health and, with some of the trades, for periods of unemployment. The various Acts added nothing to the burdens of people who were already insured with the various provident societies, but brought into line all those who had neglected to take any heed for the future.

All persons between 16 and 70 employed in the United Kingdom, whether they be apprentices, manual labourers, employees receiving weekly or other wages, or those engaged under contracts—in fact, everyone whose rate of wages, salary or remuneration does not exceed £250 a year, must be insured, and so must those serving in a British ship. There are, indeed, no exceptions, other than a few most unusual instances.

National Health Insurance

In the case of men the weekly contribution to the National Health Insurance amounts to tenpence; with women the contribution is ninepence. The entire responsibility for seeing that the payments are made regularly and at the proper time rests with the employer, and he is authorised by law to deduct the amount from the employee's wages when paying him. The most generally accepted routine is for the employee to produce his card at the time his wages are paid so that it may be stamped, but in many instances, and particularly in cases where the employment is of a permanent character, it is quite the custom for the employer to retain possession of the card, though he must hand it to the employee when asked to do so, and the card itself is technically the property of the Insurance Commissioners.

And here it should be explained that, although all contributions must be paid by means of stamps obtainable through the Post Office, the bulk of insured persons are attached to friendly societies. Thus in a recent year of some 14 millions of insured people about two-thirds were insured with approved friendly societies, industrial insurance companies, trade unions and collecting societies. The point is that an insured person may receive proportionately greater sickness and other benefits by belonging to an approved society rather than by merely depositing his card with the Post Office and relying entirely upon the bare provisions of the State to give him his benefits.

Employers' Responsibilities

So far as an employer is concerned, his chief responsibility is to see that every time wages are paid a stamp is affixed in the place provided upon the current insurance card. The stamp must be a National Health Insurance stamp, and neither revenue nor postage stamps to the required amount are accepted. The National Health Insurance stamps are obtainable through any post office, and employers may purchase single stamps covering contributions for periods of 13 weeks at head and branch post offices; but where such stamps are issued the employer is called upon to fill in a form of application which sets forth the precise conditions upon which they are issued.

At the time the stamps are affixed to cards they must be cancelled by writing the date across them in indelible ink, or by impressing the date upon them with a metallic stamp. In large businesses it is often arranged that the cards shall remain during their currency in the custody of the cashier, and he will make it a rule to produce and stamp the cards the day before wages are paid or when he is making up his wages. For the purpose of systematisation these cards are often kept in an indexed cabinet,

so that at any time a required card may be quickly produced.

Of the 14 millions of insured people during a recent year a considerable proportion must have received benefits, for the total expenditure of the year on Health Insurance was estimated at over 16 millions sterling. Of this amount 12 millions were spent in direct benefits, 2½ millions upon the administration of the Acts, and nearly 2 millions upon medical treatment. To this total the State contribution amounted to about 6¾ millions.

We will now consider the actual amounts payable by employer and employee in the different circumstances outlined. In cases where the insured person is under 21 years of age, where board and lodging are not given, or where the employee's wages do not exceed 4s. per day, the contribution of the male employee becomes 4d. weekly and that of the employer 5d.

Sickness Benefits

And here it may be explained that during the sickness of the employee no contributions at all are payable and no notice is taken afterwards of the arrears occurring during such periods. In the same way the employee is not called upon to provide stamps during periods of unemployment, though in some cases it is to his advantage to make up the arrears in order that he may receive the full benefits from his insurance.

In the case of women, the contribution to the insurance card and the amount to be deducted from the wages is in every instance a penny less than that pertaining to men.

With some trades or callings, and in certain districts, a custom prevails for an employer to pay in full the wages of an employee during sickness, and in such cases there is a rule under the National Health Insurance whereby an employer may make a contract with the Commissioners definitely to this effect. Then, if he guarantees to pay his employees during sickness up to a duration of six weeks in any one year, a reduced subscription of 2d. a week for men and of 1½d. a week for women becomes payable. This rule does not apply to persons in receipt of 10s. a week or less, and in every case the employer must obtain one of the official forms and give notice of his wish to adhere to this arrangement.

But in addition to the insurance of employees another branch of the National Health Insurance holds out inducements to those who will become voluntary contributors. In this class are included small tradesmen, agents and others who are not strictly speaking employed persons. At the same time they follow more or less regular avocations and are wholly or mainly dependent for their living upon the earnings so gained, and they, so long as they are under 65 years of age, may receive certain benefits.

Under this system of voluntary contributions there is no differentiation between men and women. For those under 45 years of age the contribution is at the rate of 10d. per week, but it rises according to the age of the contributor.

From the point of view of business and commerce it is necessary that we should understand both the benefits arising from and the penalties attaching to the National Health Insurance.

To deal first with the latter point, an employer of labour who fails to pay his contributions as they become due is liable on summary conviction for each offence to a fine not exceeding Ten Pounds, and in addition must make good any deficiency in contributions.

Fines and Penalties

At the same time the employee is also under severe penalties, for if he fails to deliver his contribution card to his employer, or is guilty of any other acts of non-compliance with the law, he too becomes liable to a fine not exceeding Ten Pounds. Again, those who buy or exchange the National Health Insurance cards of others are liable to be heavily fined.

The actual benefits of the National Health Insurance may be summed up as free medical attendance and treatment during sickness for the persons insured. For consumptive cases there are also sanatoria available.

Men contributors during their sickness receive 15s. weekly and women 12s. up to a period of 26 weeks. There is a further disablement benefit of 7s. 6d. a week. One of the most vital benefits of the State Insurance has to do with maternity, mothers who are insured, whether they be married or single, receiving 40s. as a maternity benefit; whilst in those cases where both husband and wife are insured the wife receives the maternity benefit concurrently with the husband's claim.

At present the Unemployed Section of the Insurance Acts is applicable only to certain prescribed trades and is not in general use.

A. B.

CHOOSING A CAREER.—XLII

Fishmongers.—In the south-east of England the principal market for the supply of fish to retailers is Billingsgate, London. In the country tradesmen obtain their supplies direct from Grimsby and other ports, or from local municipal markets. The trade is often combined with that of game dealer and poultry purveyor.

In this business the amount of capital required is not so large as with the majority of shops. The stock is renewed practically from day to day and the money turned over freely. Fittings also are not expensive. To learn the trade a beginner should seek employment as an assistant at an established fish shop.

Florists.—This trade has been increasing in stability for many years and most town-dwellers now purchase flowers for table much as they buy foodstuffs. Very little capital is required to start a florist's shop and the profit on each sale should be nearly cent. per cent. At the same time, it must be remembered that flowers remaining unsold at the close of the day count as net losses.

Footballers.—In these days of organised sports there are literally thousands of professional footballers. Those in the employ of the large league clubs are retained throughout the year; lesser clubs engage men who follow some ordinary vocation during most of the week.

To become a professional footballer it is of course necessary to be unusually skilful at the game itself. Any youngster who has good promise should write to the secretary of his favourite professional club and ask for an interview and trial.

Furnishers, Antique.—To the man who is whole-heartedly interested in antiques and who is to some extent a practical wood-worker himself, the building-up of a business as a dealer in old furniture presents the possibilities of a lucrative and fascinating calling.

Antique furniture experts are drafted from the assistants and salesmen in such businesses, from attendants at auction rooms and similar classes, and a man without sound, definite knowledge to back his judgment would inevitably fail.

Furnishers, House.—In some parts of the country lads are taken as apprentices to live in; but, in other parts, they are merely engaged as paid learners and junior assistants. The salesmen are paid very largely on commission, and it needs a great many years thoroughly to learn the business in all its aspects. Those workers who have enjoyed a little practical experience in the furniture factories are likely to attain to the greatest success.

Furriers.—In this business it is usual for the assistants to be apprenticed for three or four years, and with first-class houses a premium is required. Little more than pocket money is in any case paid during apprenticeship, and the trade is one that is most difficult to learn in all its branches.

To open a furrier's shop very considerable capital is necessary. It will be obvious that a good-class shop is most important, and the stock itself will involve a large outlay. Moreover, the season for furs is only of limited duration. Apart from the sales, however, a good deal is to be earned from the repair and alteration of furs; and from their safe storage for customers during the summer.

Gas Workers.—In the making and supply of gas for lighting, heating and power purposes there is employment for many grades. In the gas-works themselves there are tasks for stokers, retort men, gas-holder attendants, watchmen and many others. The stoking is mainly performed by automatic hoppers, and modern machinery has dispensed with much of the very strenuous toil that formerly prevailed. Boys may begin as labourers and assistants and work their way upwards through the various stages.

Highly-trained engineers and chemists are employed in the manufacture of gas; and under most of the county councils there are chemist testers who examine the public supply of gas daily. In the offices of the gas companies, whether municipal or incorporated, there are openings for clerks and accountants, and the meter readers and collectors are mostly drawn from the clerical staff. For repair and installation work a staff of inspectors, plumbers, gasfitters and labourers is maintained and there are also roadmen who attend to the mains.

Gentlemen's Outfitters.—In a busy thoroughfare a shop of this nature can be made most profitable. The chief points are smart and original window dressing, the latest fashions and novelties in the stock, a close regard to the seasons and plenty of enterprise. The stock represents a considerable item, but for £500 quite an average shop could be opened.

Geologists.—Special scientists of this class are employed by mining companies, by the Government, technical institutes, museums, and so on; and a knowledge of metallurgy generally accompanies the other study. The fees to be earned are not usually

high. Assay work is to be studied at the *Royal School of Mines, S. Kensington, W.*

Glass Workers.—Much of our former trade in glass and glassware has been lost to Continental manufacturers, but there are still most important glass centres in England, particularly at St. Helens (in Lancashire), at Stourbridge, Leeds, Bristol and to some extent in London. Both among the flint glass workers and also in the separate trade of glass silvering and bevelling there is a system of apprenticeship, but small wages are paid and there is not usually a premium to be met.

Glaziers.—It is seldom, except with those firms that specialise in the manufacture of conservatories and glasshouses, that one finds a worker devoting all his time to glazing. Usually glazing is additional jobbing to painters, plumbers or builders' general handy men. There are some large firms, however, such as those who contract for the roofing of factories, railway stations and similar buildings, who employ glaziers.

Greengrocers.—In large centres the greengrocer will procure his supplies at the markets and in London Covent Garden is the centre of the trade. In smaller places a greengrocer may conduct a garden of his own and grow many of his supplies ; or he may deal with a local market gardener, though he will still be dependent upon the nearest wholesale market for all imported goods.

Market experience counts for most when starting in business as a greengrocer, but a little knowledge of market gardening is distinctly helpful. Many greengrocers commence with a horse and cart and a house to house round, leaving the question of a shop until they are sufficiently prosperous to undertake the responsibility.

Grocers.—Among retail tradesmen the family grocer forms one of the most important units. He is to be found everywhere ; and, in most instances, the sale of provisions is added to the grocery trade.

It requires many years' experience thoroughly to learn the trade. The best plan is to serve a period of apprenticeship and in country districts apprentices usually live in. A country shop with its wider range of stock affords more experience than one in a town. During the period of apprenticeship merely pocket money is allowed, and junior assistants in the grocery business are not well paid in view of their long hours. By far the best plan is for a lad to commence as a country apprentice and then to migrate to a city for experience in departmental stores.

Gunmakers.—It is only in very large centres that a business devoted exclusively to the sale of guns, revolvers and ammunition is to be found, and there are very few actual manufacturers of guns outside Birmingham and London. In the smaller towns it is quite common for the leading ironmonger to devote a branch of his business to this line ; and pawnbrokers are often minor specialists in guns. In sporting districts, the sale of firearms frequently goes with fishing tackle, golfers' requirements and similar stock.

The amount of capital required to start such an establishment is very considerable, and covers a wide range. Profits on individual sales are proportionately high. To start in such a business it would be highly advisable for the young man to join the ranks of the—

Gunsmiths.—These workers are to be found chiefly in Birmingham. In this city is the Gun Barrel Proof House, where approved barrels are stamped with their particular hall mark. And among the craftsmen to be found in Birmingham are gun engravers, finishers, percussioners, polishers, screwers, stockers, action filers, action makers, barrel borers, barrel filers, riflers, forgers, lock and nipple makers, sight makers and so on, in addition to gun case makers, wadding manufacturers and others.

A boy with a taste for mechanical matters should easily obtain a commencement at some branch of the gunsmithing, and should be able then to work his way through such stages as would fit him either to become a qualified gunsmith or to open a shop for the sale and repair of firearms.

Hairdressers.—This calling opens up possibilities to both men and women workers. So far as women are concerned, it is customary for them to serve an apprenticeship at an establishment where matters connected with a lady's coiffure may be studied, the premium varying from £10 to 50 guineas, according to the standing of the business. In some circumstances apprentices live in and their initial work has to do with the making-up of combings, the preparation of wigs and transformations and similar work.

Men too have to pay a premium in the high-class establishments and to serve an apprenticeship of four or five years. In the lower-class establishments a beginner may make a commencement as lather boy.

Hat Makers.—Comparatively few shopkeepers make their own hats, the work being left to the wholesale houses to be found in London and many provincial centres, par-

ticularly Stockport. There are many craftsmen engaged, such as blockers, shapers, finishers, and so on; and they are mostly paid on piece-work. Men are almost universally engaged in the making of silk and felt hats, but women enter largely into the manufacture of caps. Certainly boys and girls may obtain employment of a light nature in most hat and cap factories.

Straw hats are made almost entirely in the Luton district; and, though many men are naturally employed, a great deal of the plaiting and preparation work is in the hands of women operatives.

Hatters.—To become a hatter, i.e., a retail dealer in hats, a man should have gained experience either in a hat factory or as an apprentice and then salesman in an established business. The system of apprenticeship, however, is by no means universal, and the tendency now is for hats to be sold mainly at gentlemen's outfitting shops. There are some of the multiple shop firms specialising in hats, and they offer wide experience to a man who proposes eventually to become a retailer.

Horse Breakers.—In most parts there are workers who derive their livelihood from the breaking-in of horses. Drags and special horse breakers' harness and bits must be purchased; and it goes without saying that those who enter this business must be expert horsemen of the first class. Youngsters with a keen eye for a horse may often obtain positions as grooms at a horse breaker's establishment with a view to taking up the business.

Horse Breeders.—This calling merely represents another branch of agriculture. It forms the subject of special courses of training at agricultural colleges and horse breeders generally specialise, some acquiring a name for heavy draught animals, others for hacks and hunters, others again for military mounts or polo ponies.

In some circumstances the War Office subsidises the breeding of suitable horses, and particulars may be obtained either from the *War Office* itself, or from the *Board of Agriculture, Whitehall, London, S.W.*1.

A. C. M.

BOOK-KEEPING.—XXXVII

We have already considered (Vol. IV., pp. 119-20) the general principles which are adopted in the keeping of Branch Accounts. Difficulties, however, sometimes arise in relation to trading companies having foreign branches. In such cases the variation of the rate of exchange must be taken into consideration, and also any point laid down by the various legislatures as to the keeping of accounts. For instance, in France it is necessary that all transactions should be entered through the Journal. This is an important point and must not be lost sight of by the business man who is accustomed to consider the Journal as an extra book in which to make entries. In France the Journal is totalled at the end of the year and the total debit and credit postings in the Ledgers are taken out, one set of totals checking the other.

Foreign Currencies

The Ledger which contains the Branch Account should be ruled in three columns, the first column showing the value of the remittances in the varying currency; the second column, the particular rate of exchange on which calculation of sterling is to be based, and third the result of such calculation. In the case of remittances from a Foreign Branch or to the Branch the value should be calculated at the rate of exchange at the time of remittance.

It is necessary for the student to note certain fixed rates in relation to the adjustment of Final Accounts as between Branch and Head Office. The books at the Branch being kept in the currency of the country, it follows that the Trial Balance will be taken out in that currency. It is sent to the Head Office in an unconverted state, but, in order that the Final Accounts of the branch may be prepared and incorporated into the Head Office Accounts it will be necessary to carry out a conversion.

(*a*) The fixed assets of the Branch will be converted at the rate existing at the time they were purchased. Some accountants advise the retention of the fixed assets in the branch books, but it is often well to transfer them to the Head Office in order to avoid fluctuations of exchange. Where the fixed assets are not retained in the Branch books the Head Office will have in their books for the branch, a Plant and Machinery Account, a Furniture and Fittings Account, and the like. Such accounts will be debited with the original capital expenditure and subsequent additions, and credited with depreciation which will be debited to the Profit and Loss Account.

(*b*) The values of fluctuating assets are converted at the rate of exchange on the date of sending accounts over, the reason for this being that, should it be necessary or desirable to realise at the date of taking

CONVERSION OF TRIAL BALANCE.

Dr.											*Cr.*
	Fs.	Rate	£	*s.*	*d.*	Fs.	Rate	£	*s.*	*d.*	
Sundry Debtors ..						8,805	25·12	350	10	4	
Stock						10,613	25·12	422	9	10	
Remittance A/c ..						6,707	Actual	266	13	4	
Net Profit	2,015	25·15	80	2	4						
Sundry Creditors ..	6,110	25·12	243	4	7						
Head Office A/c ..	18,361	Actual	730	1	6						
Cash in Hand ..						361	25·12	14	7	5	
	26,486		£1,053	8	5	26,486		£1,054	–	11	

There is a difference (due to rates of exchange) of 12s. 6d. between totals of Debtor and Creditor Balances which is adjusted in the books of the Head Office.

accounts, the realisation would produce sterling at the rate of exchange of the day. That is, the value of Sundry Debtor and Creditor balances in sterling will be calculated at the rate of exchange prevailing at the closing of accounts.

(*c*) Remittances are converted at the rate of exchange prevailing when the remittance was made, whereas Profit and Loss items being spread over the financial period under examination are converted at the average rate of exchange for the whole period. Thus, rent being a charge extending over a period, is not converted at the rate at the commencement of the period or at the end of the period, but these various rates averaged.

(*d*) The balance of the Head Office Account will, of course, be already converted as being the net balance outstanding at the time of last balancing, and so the rate of exchange at this time will be the governing factor. Let us consider the following example :—

The X.Y.Z. Manufacturing Company, having a Paris Branch, receive the Paris Trial Balance and a copy of the Profit and Loss Account as on December 31. The balances are as follows :—

	Fs.
Sundry Debtors	8,805
Stock	10,613
Remittance Account	6,707
Net profit as per Profit and Loss Account	2,015
Sundry Creditors..	6,110
Head Office Account	18,361
Cash in hand	361

The rate of exchange at the time of making up the accounts was 25·12. The average rate during the financial period was 25·15, whilst the Remittance Account being based on actual realisation of the various remittances was £266 13s. 4d. The Head Office Account showed a sterling value of £730 1s. 6d.

Conversion of foreign currency into sterling money is a matter which requires considerable practice. The student is advised to learn the rules given above and practise the arithmetical rules on which the conversion is based, thus :—

Where the exchange between London and Berlin is 20·4 find the sterling value of 17,370·6 marks.

$$17{,}370{\cdot}6 \text{ ms} = £\frac{17{,}370{\cdot}6}{20{\cdot}4} = £851\ 10\text{s.}$$

Similarly—

£851 10s. = £851·5 = 851·5 × 20·4 marks
= 17,370·6 marks

Exercise

The Trial Balance of the Bombay Branch of P.Q. and Company on December 31, 19.., was as follows :—

	Dr.	*Cr.*
	Rupees.	Rupees.
Stock on hand	2,750	
Purchases	16,500	
Sales		24,750
Sundry Debtors	5,500	
Sundry Creditors		3,850
Bills Receivable	1,650	
Bills Payable		1,100
Wages and Salaries	1,100	
Rent, Rates and Insurance	825	
General Expenses	330	
Fixtures and Furniture ..	1,100	
Cash at Bank	7,150	
Cash in hand	220	
Head Office		7,425
	37,125	37,125

The rate of exchange at the end of the financial period was 16, the average during the period was 15, the rate at the commencement of the financial period was 14½, and the balance disclosed in the Bombay Branch Account in the Head Office books £493 1s. 9d.

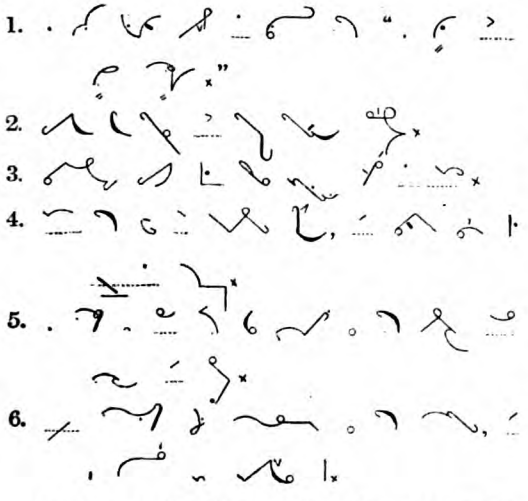
Rule up a form similar to the example given in the Lesson and convert the figures into sterling for incorporation in the Head Office books. F. H.

SHORTHAND.—XXI

Key to Exercise 75

1. *The* soldier provided entertainment *for-the passengers by-his* narratives *of-his* experiences.
2. *We-think-the* articles *are identical, and* beg *to* say *your* conduct *is monstrous in-the* face *of-our* attitude *in-the*-matter.
3. *Our member* asked *for*-some *enlightenment on-the* actions *of-the ministry.*
4. *The manuscript was very imperfect and-not a* good *introduction to-the subject in*-question.
5. *We*-were engaged *in perspective* drawing *on-the* date *of-the demonstration.*
6. *Your architect* took *objection to-the obstruction, and so we-had to* remove *it.*
7. *The* film entitled "*The Destruction of-the* Cruiser" *is an* excellent *production.*
8. *We-have-no objection to-the* nomination *of-the prospective* candidate.

Key to Exercise 76



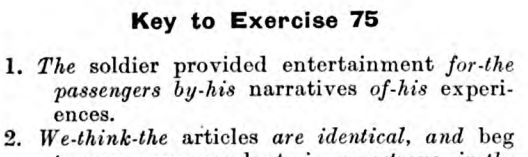
Vowel Indication.—By the expression vowel indication is meant the writing of outlines in such a manner as to indicate vowels without inserting the vowel-signs. In this Lesson, vowel indication will have full treatment, and the student will no doubt find that he is already familiar with the general idea.

It is, of course, obvious that when writing at a rapid rate it is not possible to insert many vowels, and it is therefore of the greatest importance that the student should write outlines that can be read easily when vowel-signs are omitted.

It will be remembered that there are two main principles to be observed for the purpose of indicating vowels—

(a) *By an initial or a final stroke.*

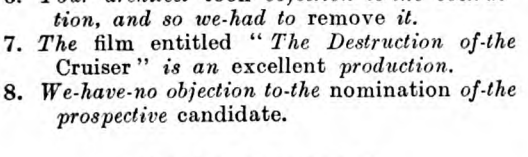
The student should carefully examine the following pairs of outlines—



From the foregoing examples we may deduct the following definite rule: *The use of an initial stroke is necessary in all cases where there is an initial vowel; the use of a final stroke is necessary in all cases where there is a final vowel.*

(b) *Alternative forms.*

Note the following pairs of outlines—



From these examples we gather that *the employment of alternative forms for* R *or* L *may indicate an initial or a final vowel.*

It should be noted, however, that easiness of outline forbids the use of *r* and *l* as vowel indicators on all occasions. The rules regarding *r* and *l* should here be referred to, and the exceptions to the above general rule carefully noted. (*See* Lessons II and V.)

Exercise 77

Key to Exercise 77

1. Esk, sake, Casey, race, racy, mass, Massey, assail, awoke, rust, rusty.
2. hair, hairy, fur, furry, oar, row, veal, villa, dust, dusty.
3. paste, pasty, pen, penny, rain, rainy, alike, like.
4. arrayed, aright, bill, billow, coal, coaly, grocer, grocery.

POSITION WRITING.—In addition to the foregoing methods of indicating the presence or absence of vowels, there is what is termed *position writing*, by which we can indicate the vowel, or, if more than one vowel, that which is accented in the word. Position writing is defined as the raising or lowering of outlines to indicate a vowel or diphthong, without

inserting the sign for it. The student has already noted that logograms are sometimes placed *above*, *on*, or *through* the line, as, for example—

(1) *happy*, *large*, *happen*;

(2) *done*, *ever*, *up*;

(3) *through*, *out*, *put*.

It will be seen that the vowel or accented vowel is *first*, *second*, or *third-place* respectively. From this we gather, therefore, that there are three positions, corresponding to the vowel-places, in which outlines are written when the vowels are omitted. These positions are termed respectively *first position*, *second position*, and *third position*: the first *above* the line, as in *happy*; the second *on* the line, as in *up*; and the third *through* the line, as in *put*.

Note carefully the following examples—

(a) *bat*, *dock*, *barrow*, *rack*, *mile*, *file*, *Filey*.

(b) *boat*, *duck*, *berry*, *rake*, *male*, *fail*, *fellow*.

(c) *bit*, *duke*, *bureau*, *rook*, *meal*, *feel*, *filly*.

There are, therefore, the three definite rules—

(1) When the vowel or accented vowel in a word is a first-place vowel, the outline for the word is written in the first position (*i.e.*, above the line).

(2) When the vowel or accented vowel in a word is a second-place vowel, the outline for the word is written in the second position (*i.e.*, on the line).

(3) When the vowel or accented vowel in a word is a third-place vowel, the outline for the word is written in the third position (*i.e.*, through the line).

It is obvious that there can be no third position for outlines consisting of horizontal strokes only, or of horizontal strokes joined to half-length strokes. Therefore when the vowel or accented vowel in such words is a second- or third-place vowel, the outline is written in the second position (*i.e.*, on the line), thus:

cake, *cook*, *money*, *minnow*, *tent*, *tint*, *colt*, *kilt*.

The first stroke indicates the position of an outline which begins with a half-length downstroke or a half-length upstroke. In these cases, also, only two positions are used. Note the following examples:

detach, *ratify*, *wandered*, *wondered*, *lightly*, *lately*, *little*.

While double-length upstrokes take three positions according to the vowel or accented vowel in the word, double-length downstrokes take the third position only (*i.e.*, through the line).

latter, *letter*, *litter*, *haunter*, *hunter*, *hinder*, *tender*, *ponder*, *thunder*, *shatter*, *floater*, *father*.

Insertion of Vowels.—The application of the foregoing three rules for the indication of vowels does not always provide the most readable outlines, and it is sometimes desirable that word-outlines should to some extent be vocalized. The following directions should, therefore, be carefully noted—

(1) In single stroke outlines which have an initial vowel, the vowel not indicated by position should be inserted; thus,

Eva, *arrow*, *area*.

(2) Position writing does not dispense with initially or finally-joined diphthong-signs. These are very helpful in reading notes.

ivory, *item*, *few*, *future*.

(3) Where the upward or the downward *r* or *l* does not indicate a preceding or a following vowel the vowel-sign should be inserted, as in

aright, *earthly*, *billow*, *early*.

The following exercise should now be worked, all outlines to be placed in proper position, and any necessary vowels inserted.

Exercise 78

1. talk, mock, diary, laugh, leaf, aloof, wire, carry, mail.
2. lightly, pandered, splintered, meter, mate, latter, litter, later.
3. right, aright, billow, coal, coaly, deadly, wandered, loiter.
4. allay, artist, arrayed, Polly, pillow, jelly, aroma.
5. *If-you wish to*-write *at a* fast rate, *you-must* master *each of-the* rules. Speed *largely* depends *on a* thorough acquaintance *with-the* theory.
6. *You-are* advised *to*-read *and* copy printed *shorthand*, *and so* cultivate *a* neat *and* accurate style.

Continued from page 130.

ENGLISH LANGUAGE AND LITERATURE:

Contributors:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

NINETEENTH CENTURY POETRY.—III

PERCY BYSSHE SHELLEY, a poet of revolt against the reactionary tyranny that throughout Europe followed the French Revolution, and the most lyrical of modern English poets, was born at Horsham August 4, 1792, a son of Sir Timothy Shelley. An eccentric visionary boy, he was in revolt against his father, his Eton masters, and the Oxford University authorities. Before he had been a year at the University he was expelled for advocating atheism. At the age of nineteen he married an unsuitable wife. In less than three years the ill-assorted pair agreed to a separation. During his boyhood and early years of married life Shelley wrote copiously in prose and rhetorical verse, his only considerable work being *Queen Mab* (1813), an immature attack on the God of Christianity as conceived by aggressive atheism.

Shelley and William Godwin

At this time Shelley was quietly influenced by William Godwin, the materialistic radical of the period, and, adopting Godwin's views of marriage, eloped to the continent with the philosopher's daughter Mary (1814). Thus far Shelley's life was waywardly impractical. He had been a restless wanderer, pursued by poverty and unhappiness. But in 1815 his circumstances improved, as his father inherited the family estate and made him a substantial allowance lest he, as the next heir, should encumber the estate. Next year Mrs. Shelley committed suicide.

Shelley published in 1816 his first true poem, the blank verse *Alastor: or the Spirit of Solitude*, inspired by his visit to Switzerland and the Rhine, and a closer companionship with the scenery of his own land. He now wrote in the Spenserian stanza *The Revolt of Islam*, a fiercely sympathetic survey of the French Revolution and its tyrannous sequels (1818).

The importunities of his father-in-law and others who took advantage of the poet's improved finances and generous nature, and his love of Alpine scenery, which he had indulged a second time in 1816 in Byron's company, induced him to leave England (March, 1818), for Italy, whence he never returned. During the six years which followed he wrote the poems that have been his passport to "the abode where the eternal are."

He was drowned, July 8, 1822, through the capsizing of a boat in which he was sailing from Leghorn to Spezzia. His body was cremated on the shore by Byron and Leigh Hunt near the place where it was washed up, and the ashes were buried close by the grave of John Keats in Rome, of which he had written "it might make one in love with death to think that one should be buried in so sweet a place."

Adonais

Shelley's chief works during his Italian period included *The Cenci* (1819), a powerful blank verse tragedy on a theme which unfits it for stage use; the symbolic drama *Prometheus Unbound* (1820), largely lyrical in spirit and structure; *Adonais* (1821), a lovely Spenserian lament for the poet's friend, John Keats; and *Hellas*, a lyrical drama inspired by the struggle of Greece for liberty, ending with the passionate plea against fratricidal strife:—

> Oh cease! must hate and death return?
> Cease! must men kill and die?
> Cease! drain not to its dregs the urn
> Of bitter prophecy.
> The world is weary of the past,
> Oh, might it die, or rest at last.

The Cenci and *Prometheus Unbound* are dramatic protests against tyranny in any form. *The Mask of Anarchy*, written in 1819, but not published till after the poet's death, is a trenchant and bitter exposure, for popular reading, of the combined effects on the mass of the people of the Napoleonic wars, political reaction, and the blighting growth of unregulated industrialism. *Julian and Maddalo* is a poetical summary of talks with Byron in companionship on the Venetian lagoons.

It was during these Italian years that Shelley was writing the matchless lyrics that by their melody and grace will preserve for him popularity among multitudes who will not read his longer poems. *The Cloud*, *The Skylark* and the *Ode to the West Wind*, all published with *Prometheus Unbound*, are imperishable examples, the last epitomising more of the poet's spirit, poetic impulse and outpouring method than any of his poems.

Make me thy lyre, even as the forest is:
What if my leaves are falling like its own!
The tumult of thy mighty harmonies
Will take from both a deep, autumnal tone,
Sweet though in sadness. Be thou, spirit fierce,
My spirit! Be thou me, impetuous one!
Drive my dead thoughts over the universe
Like withered leaves to quicken a new birth!

John Keats

Shelley never reached his Spring. He is one of the few who, greater than he showed himself to be, died with half his music in him. Shelley's passionate devotion to Liberty, his faith in the power of Love as the world's healing grace, and his sublimated sense of beauty in Nature and in Man will ever charm the poetic reader of his longer poems despite their tendency to a dispersive fineness. But it is as a master of lyrical form that he stands supreme, clothing in mellifluous words the airy changes of fancy with a blending grace like that of Nature's own scenic artistry, when she paints her changeful pictures of land and sea and sky.

The story of John Keats is even more pathetic in its suggestion of incompleteness than that of Shelley. Of Keats Tennyson said: "With his high spiritual vision he would have been, if he had lived, the greatest of us. There is something magic and of the innermost soul of poetry in almost everything which he wrote."

Like Milton, Wordsworth, Shelley and Tennyson, Keats lived for poetry. But his short life was shadowed, as he thought, by failure, and by the oncoming death which reached him in his twenty-sixth year.

He was born in London, October, 1795, the son of a fairly prosperous owner of a livery-stable, who died when the boy was eight years of age. There was sufficient money in the family for the children to live in careful independence. At first Keats studied for the medical profession, but when he came of age determined to give himself up to poetry, he now having his first volume ready for the press. It was published in March, 1817.

For several years Keats had been familiar with Leigh Hunt and the painter Haydon, and through them came into touch with a notable literary circle, men of strong liberal tendencies—Hazlitt, Lamb, Shelley—with whom he sympathised, and in the circle but not now of it, Wordsworth. Leigh Hunt's own verses influenced the young poet strongly at first, but soon he outgrew them, and passed under the sway of Wordsworth, before, with rapid advances, he began to form his own style.

Adverse Criticism

The *Poems* of 1817 fell flat, though they were praised by Hunt, to whom they were dedicated. That dedication was quite sufficient provocation to the opposite political clique to cause them to lie in wait for any further publication by the young poet. This came in 1818 when the poetic romance *Endymion* was issued. *The Quarterly Review*, "savage and tartarly," and *Blackwood's Magazine* poured on the volume the venom reserved for political opponents and the friends of opponents.

In 1820 Keats, who was now hopelessly in the power of consumption, published his third volume, *Lamia and Other Poems*, containing a fragment of a proposed epic —*Hyperion*. The critics were now compelled to admit, however grudgingly, th poet's merits. Keats, however, was too ill to care what they said. A journey to Italy brought no relief, and he died in Rome, February 23, 1821, fearing he had missed the fame he sought, and that his name was "writ in water."

It is on the 1820 volume that the fame of John Keats as a poet unsurpassed in romantic imagination and delicate, classical workmanship, chiefly rests. The first (1817) volume included the splendid sonnet *On First Looking into Chapman's Homer*—"Much Have I travelled in the Realms of Gold"; the nature-poem beginning "I stood tip-toe upon a little hill"; and the *Sleep and Poetry* poem in which the poet fiercely attacked the versifying style of the school of Pope, who

"swayed about upon a rocking horse and thought it Pegasus."

The volume of 1818, *Endymion*, brought back Greek mythology into English poetry, although its author had not received a classical education. But from boyhood he had been saturating himself with the poetical conceptions that served the Greeks for a religion, and he knew well the copious references to the mythology of Greece that abound in the works of the scholarly poets of the Elizabethan Age, notably Spenser, Drayton and Chapman. On the foundation of this reading his prolific imagination recast the ancient myth of *Endymion*, who typifies the poet in search of the beauty which, according to the first line of the poem, is "a joy for ever."

The narrative thread of the poem is far from clear at intervals, the tone now and again becomes unnecessarily sensuous, and the verse often echoes obviously the writers whom Keats admired most, but against

From the miniature by Severn, in the National Portrait Gallery.

JOHN KEATS (1795–1821),

a poet unsurpassed in romantic imagination and delicate, classical workmanship.

these drawbacks must be set a wealth of imagination unexampled since Milton, and a choiceness of phrase that suggested a literary master in the making.

From the 1820 volume a larger proportion of poems has passed into the choicest selections than from almost any book of verse in the language. *Lamia*, the title poem, finds in Greek mythology an illustration of the fatally bewitching power of love. In *Isabella, or the Pot of Basil*, a gruesome story is amplified from Boccaccio in most delightful verse. Keats had now attained in his writing consummate grace and ease. *The Eve of St. Agnes*, written in the Spenserian stanza, is a romance of abduction of the *Young Lochinvar* type, uniting melody with strength. Then the volume included the in-

From the portrait by Clint in the National Portrait Gallery.

PERCY BYSSHE SHELLEY (1792–1822),

who, as a master of lyrical form, stands supreme.

imitable Odes *To a Nightingale, On a Grecian Urn*, and *To Autumn*, in which delicacy of fancy and of literary workmanship reach the goal of perfection. The book closes with the great epic fragment *Hyperion*, a story of strife among the gods, conceived and executed in the Miltonic vein, and suggesting beyond all his other works the magnitude of the world's loss in the early death of Keats.

Among poems published posthumously are two of great interest, the magically weird ballad of *La Belle Dame sans Merci*, and the fragmentary *Eve of St. Mark*, a descriptive scene steeped in romance like earth under the evening glow, but sketched in the simplest of wording.

John Keats was more nearly the born poet than any of whom we have a full record. His verse, at first imitative and casual, gained in strength and finish with astonishing swiftness, until it had qualities of invention, of selection, of force and of grace that ranged it alongside the best for comparison. And Keats ceased writing at the age of twenty-

four. What might he not have become if twenty more years had been allotted him! As it is he is the most marvellous of the poets who died young.

Alfred, first Lord Tennyson, the representative poet of the Victorian age, was born August 6, 1809, at Somersby, Lincolnshire, a son of the rector. He was educated at Louth Government school, at home by his father, and at Cambridge University by noble friendships. From boyhood he lived to be a poet, and the story of his literary career is the story of his life.

In his infancy he wrote imitative verse, and when he was seventeen published locally a small volume with his brother Charles, a year older, and Frederick, two years older than himself. At Cambridge he won the Chancellor's medal with a blank verse poem on *Timbuctoo*; and in 1830, while still at Cambridge, issued *Poems, Chiefly Lyrical*, now included in his complete works as *Juvenilia*. These verses, obviously echoing Keats and Coleridge, were largely exercises in verbal melody, but they also had a clear note of their own, which announced a poet of rare promise, dowered with "the hate of hate, the scorn of scorn, the love of love."

Tennyson's Masterpiece

The year after leaving Cambridge (1832, but dated 1833) the young poet published another volume simply entitled *Poems*. No longer ought there to have been any doubt as to the gift the world had received, for the book included that romance in porcelain, *The Lady of Shalott*, prophetic of the later Arthurian poems, the too-sentimental *May Queen*, the first drafts of *The Palace of Art*, *A Dream of Fair Women*, and *The Lotus Eaters*, the last, in its perfected form a masterpiece which the poet never surpassed.

The poet's delicate art, like that of Keats ten years earlier, came under the lash of the brutal criticism of the day, and for the next ten years Tennyson remained silent, recasting his early work and adding to it in a quietude not far removed from poverty, for his father was dead and the family had suffered heavy losses. In 1833 also his life was overshadowed by the death of his dear college friend, Arthur Hallam, son of the historian.

In 1842 appeared *Poems in Two Volumes*, containing revisions of the earlier poems and additions which established Tennyson's position as the poet then living from whom the world could expect most. The volume included a number of charming short tales and sketches in verse, like *The Lord of Burleigh*, *Lady Clare*, *The Talking Oak*, *Godiva*, *The Gardener's Daughter*, and *Locksley Hall*, with its fine swinging measure and its questioning outlook towards the future—an inquiry that was destined to be often renewed.

The colouring given to the poet's mind by his sorrows could be traced in such poems as *The Two Voices* and *The Vision of Sin*. That his thoughts were busy with the Arthurian legends was revealed in *Sir Galahad*, and the exquisitely cadenced *Morte d'Arthur*, afterwards incorporated in *The Passing of Arthur*. Classical subjects, first introduced in *The Lotus Eaters*, which now was extended, reappeared in *Tithonus* and in *Ulysses*, the most perfect and haunting example of blank verse ever achieved by Tennyson, and unexcelled by any master of that measure. It was the reading of *Ulysses* to Sir Robert Peel by Richard Monckton Milnes (afterwards Lord Houghton) which led to the grant of a civil list pension of £200 a year to the poet in 1845.

Poet Laureate

Throughout the forties Tennyson's popularity was growing steadily, and was accelerated by *The Princess*, published in 1847 without the lovely lyrical interludes which are now the most admired part of the poem. They were added in 1850, the year when *In Memoriam*, a sequence of short bursts of song, appeared, commemorating the death of Arthur Hallam, and the gradual waning of the poet's grief, with his accompanying thoughts on the problems of life and religion, suggested by the growth of scientific knowledge and the changing bases of faith. Almost simultaneously with the publication of *In Memoriam* Tennyson was appointed poet laureate in succession to Wordsworth. The influence of *In Memoriam* was profound. No other English book has had an equal effect in broadening the religious outlook.

Tennyson's first considerable poem as laureate, his *Ode on the Death of the Duke of Wellington* (1852), has taken rank as the finest elaborate elegy in the language sketching the life and character of a great public man. Its solemn dignity is relieved by skilful modulations of rhythm. Later, the poet again and again expressed the national pride in poems that gave a glory to the laureateship it had never known before—as in *The Charge of the Light Brigade*, *The Defence of Lucknow*, and *The Revenge: a Ballad of the Fleet*, an immortal setting for an immortal deed.

Though Tennyson was gradually attaining a general popularity scarcely paralleled during a poet's lifetime, criticism kept up a

From the picture by Frank Stone.

THE DUET.

A characteristic Victorian scene in which are shown Tennyson (gazing at the players) and Charles Dickens (seated).

snarling undertone that rose to a chorus when *Maud* was published in 1855, the objectors failing to see this brilliant effort as a psychological study outside of the poet's own personality.

Tennyson knew that what was expected from him was a poem epic in style and magnitude, and for many years he worked on the Arthurian legends, and in 1859 added to the *Morte d'Arthur Enid*, *Guinevere*, *Elaine* and *Vivien*. They received an almost unanimous welcome. The remaining *Idylls of the King*, making twelve in all, appeared at intervals, and were not completed by publication until 1885. They do not form an epic, but are rather a series of Idylls, modernising Malory and interweaving into his stories symbolic significances after the manner of the *Faërie Queene*. Their interest is uneven, and as a series with a common aim they are but loosely knit.

Tales of Simple Folk

In 1864 the poet reached a national popularity with his story of simple life, *Enoch Arden*, the book by which he is best known to the European world through translations. With this volume appeared the first of a succession of poems in the Lincolnshire dialect that revealed a strain of humour, and a power of sketching homely character that had not been recognised before, and that gave the poet a human breadth seen only in Shakespeare and Chaucer among the greater poets.

Between 1875 and 1891 Tennyson published three complete dramas, *Queen Mary* (1875), *Harold* (1876), and *Becket* (1884), and four short pieces for the stage. Though his plays are poetic and dignified, and *Queen Mary* and *Becket* were produced by Irving with a fair degree of success, *Becket* holding its own to the last in the great actor's repertoire, Tennyson's genius was not dramatic.

To the end, which came on October 6, 1892, with a noble quietude, the poet continued to write, repeating with but little loss of power the themes of his manhood—human destiny in *De Profundis*, *The Ancient Sage*, *Vastness*, and *The Making of Man* ; the poet's progress in *Merlin and the Gleam* ; studies of sorrow in *The First Quarrel*, *Rizpah* and *To-morrow* ; reversions to classical subjects in *Tiresias*, *Demeter and Persephone*, and *The Death of Œnone* ; and ballads, songs, and musical fragments down to the exquisite farewell, *Crossing the Bar*. He is buried in Westminster Abbey, side by side with Browning, and his life has been written once for all by his son. J. D.

POLITICAL ECONOMY.—V

WHEN we speak of Credit and the Credit System, we refer to the custom which exists of either deferred payments for goods purchased, or the system adopted by the Banks of advancing money either against goods in course of transit from one country to another or by the discounting of Bills of Exchange.

As we have seen in the previous article, the source of money is the payment for goods, but a vast amount of the trade and commerce of the country is carried on without the exchange of a single coin, so that the amount of actual money which passes from one person to another in the course of a year is no criterion of the volume of trade done in that country. Few tradesmen pay for their goods in gold or specie. The Banking system is much more convenient.

Few people, if any, except the miser, keep large sums of money in their own possession. They keep sufficient for their immediate and personal needs, and the rest is deposited in the Bank or, in other words, they lend their money to the Banker, who, in his turn, lends it to his customers.

Stability of Banking

If the account is an ordinary trading account, the Banker will not pay any interest on the money, or he may even charge a percentage as his reward for keeping the money safely and recording the transactions in his books. The Bank of England pays no interest on its customers' balances, and makes a stipulation in the majority of cases with the customers that the amount standing to a customer's credit shall never be less than £500.

In a Bank we find the first element of Credit, namely the " confidence " which the customer has that the money he deposits is secure. He has confidence not only in the honesty of his Banker, but in his ability to pay back his money when he requires it.

In addition to the gold and silver currency, the Bank of England, and a few Provincial and Private Banks issue notes of various denominations from £5 upwards, and in Scotland and Ireland £1 notes and £5 and upwards. These notes are promises to pay on demand, and the Bank of England is compelled by law to pay its own notes in gold, while other Banks are compelled to pay in gold coin or Bank of England Notes. A Bank of England Note is a legal tender, but other notes are not a legal tender. The Bank of England has a sufficient supply of gold and securities to meet all its notes, but

in actual experience it is found that it is only necessary to keep in hand a sum in gold amounting to about one-third of its issue.

Prior to 1844 there was no limit to the issue of Bank Notes. But in order to prevent the abuse of credit and the inconvenience of commercial panic, the Bank Charter Act of 1844 was passed, which provides that if the note circulation of the Bank of England exceeded the value of its securities, the Governors shall be compelled to keep an equivalent to the excess either in gold or bullion.

For the further security of the public, the Governors of the Bank are compelled to issue a weekly statement showing that the property of the Bank in the Funds or in Gold is equal in value to the whole of the notes issued. The Act also prevents other Banks from increasing their issue of notes, and provides that no Bank established after the passing of the Act shall be allowed to issue notes.

Bank Note Currency

The addition of Bank Notes to the currency under proper restrictions proved a useful substitute for money on account of their portability and convenience.

Since the outbreak of the Great War gold was practically withdrawn from currency. One pound and ten shilling Treasury Notes were issued in its place; these Notes are, of course, legal tender.

The business of a Bank is not only to receive money but to lend money on safe securities. As experience shows that it is not necessary to keep more than sufficient to cover one-third of its deposits in hand, it therefore lends the balance at interest, the rate of interest being settled from time to time by the Bank of England rate varying according to the supply of money.

Some economists attribute the rise and fall of the Bank rate to the supply of new gold, while others state that the supply of gold does not affect the Bank rate, which is governed more by the state of trade. When the Bank rate is low money is said to be cheap.

Another form of Credit is Bills of Exchange. A Bill of Exchange is a written promise to pay a certain sum of money on a certain date, and is called a negotiable instrument, because the acceptor of the Bill may part with it, and the holder of the Bill, whoever he may be, is entitled to payment three days after the due date.

A Bill of Exchange is drawn by the Creditor, and accepted by the Debtor; for example: On January 1 A sells goods to B on three months credit. A then draws a Bill which B accepts payable at a particular Bank on April 1. A requires the money before April 1, so he takes the Bill of Exchange to his Banker, who either gives him the money or credits his account with the amount, and A endorses the Bill.

That transaction is called discounting the Bill, and the rate of interest is fixed by the Bank, having regard to the stability of both A and B. Assuming, however, that A's bank is not satisfied with the security, and declines to discount the Bill, or in other words to lend money on it, A may take it to a Bill Broker, who, for an increased interest, may take the risk and advance the money. The Bill Broker may put his name on the back of the Bill, which is called endorsing it, and pass it on to another Broker, or to a Bank, and in this way the Bill may pass through several hands. All the people through whose hands the Bill passes and who have endorsed it are liable to pay the amount when the Bill becomes due.

Bills of Exchange

Bills of Exchange, cheques, bank drafts, are all passed through the various Banks, but the Banks do not pay each other in cash on each individual transaction. An exchange takes place in what is known as the Clearing House. To this place the bankers send all the cheques, bills and drafts paid into their Bank during the day, and there an Exchange takes place for cheques and bills drawn on their own bank. In this way transactions take place, and more than £20,000,000,000 of cheques and other negotiable instruments are exchanged in a year without requiring any specie, that is to say, it is all done by book-keeping entries.

The following very clear account of credit is given by Lord Farrer in his book "What do we pay with."

"The debt or credit is either the consideration for goods already sold or services already rendered, or it is an anticipation of the proceeds of further sales or future services."

If a Banker discounts a bill he assumes that goods have been supplied for the amount, and if he lends money to a customer he does so to enable him to carry on his business, i.e. to increase his capital and enable him to buy either goods or services; therefore it may be said that goods, not gold, is the basis of credit.

If credit is obtained too easily prices become unduly inflated about the cost of

production or natural prices, the expectation of speculators is not realised, they are unable to redeem their bills when they fall due, and a commercial panic takes place. Credit, within proper bounds, is beneficial to the community, as it stimulates trade, and prevents fluctuations in prices, which are always disastrous to production, but credit without regard to security is a danger to commerce.

Another form of credit, although often abused, has been the formation of Joint Stock Companies. The great advantages of this system of trading is that it has given the small capitalist an opportunity of investing his savings in productive enterprise, it has encouraged thrift, and by amalgamating a number of small capitals has been enabled to accomplish industrial works of the utmost importance which no Capitalist could have undertaken single-handed.

Joint Stock Companies

Our great Railway Systems have been made possible by the Joint Stock system. No capitalist could or would have found the necessary money for projects on such a large scale.

Joint Stock Companies are of two kinds: the Private Company and the Public Company. We have very little concern with the Private Company, which is chiefly formed for family reasons. An old-established and flourishing business is frequently turned into a company to ensure its being carried on after the death of the proprietor.

The business is taken to be worth a certain sum of money, and this is divided into so many shares, which are allotted to the proprietor and his family. An arrangement of this kind facilitates the arrangements in the event of the original proprietor's death, and saves complications.

We are most concerned, however, with the Public Company, which is formed either to acquire a business already in existence or to start a new business. Both the Public Company and the Private Company must be registered under the various Acts which have been passed, and are subject to very stringent regulations to prevent fraud, which was very prevalent in the later part of the last century.

A Public Company is formed by the promoters determining the amount of Capital which is necessary to carry out the undertaking. We will assume that the amount is £50,000. This is then divided into a certain number of shares, we will say £1 shares. The shares may be of any amount.

The amount of the shares is determined by the promoters, who fix the amount which is most likely to attract the investors. The class of share into which the Capital is divided is then determined. The usual method is Debentures, Preference Shares, Deferred Shares and Ordinary Shares. These shares carry different privileges.

Debentures are given at a fixed rate of interest and are a first charge on the property of the company. Preference shares are usually shares which carry a definite dividend, and a preference shareholder is entitled to his dividend before any other class of shareholder except the debenture holders.

Deferred shares are generally held by the promoters of the company, and do not take any dividend or share of the profits until the ordinary shareholders have been paid a specific interest, which is set out in the Memorandum and Articles of Association.

Ordinary shares are entitled to participate in all the profits of the company after payment to the Preference shareholders and the Debenture holders. They may be said to take all the risks and are entitled to the benefits.

Company Business

The Memorandum and Articles of Association are the Rules and Regulations which bind the company to carry on the business for which it was formed. It is usual for a company to call up its Capital by instalments, and a shareholder is bound to pay the amount of the shares which are allotted to him whether the company is successful or not, if he is called upon to do so.

The business of a company is generally controlled by a Board of Directors who, however, very rarely give any personal attention to the business, which is left in the hands of a Manager, who in many cases is a Director also and is called the Managing Director.

At one time it was not at all an unusual thing to find the Directors of a Company composed of well-known men, who lent their names for a consideration and for the fees they were to receive for attending meetings.

They were called Guinea Pigs, but the more stringent regulations introduced by recent legislation, making the Directors of a company personally responsible for statements made with reference to the prospects of a company, have had the effect of making men of means more careful to check statements made by the promoters, giving greater security to the investing public. J. W. U.

Water Buck in Eastern Equatorial Africa

From the painting by Sir H. H. Johnston

~~RED~~ ~~DEER~~

~~and fallow deer are the only large wild animals now existing in Great Britain; though bears, wolves and the wild boar became extinct within comparatively recent times (see page 231).~~

Continued from page 136.

HISTORY:

Contributors:—J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.

THE RISE OF PRUSSIA.—I

In the early Christian centuries the southern coast lands of the Baltic were occupied by numerous Eastern tribes, of which the Wends, a branch of the Slavs, were the chief. They found a country of marsh, wood and lake, inhabited by bears, bisons, boars, wolves and other wild animals. These they hunted, but their main business was to hold their territory against the encroachments of new-comers, and to effect as best they could crude settlements in the wilderness. Always at strife, however, they became in time intolerable neighbours to the adjoining German States, and Henry the Fowler (928) at last captured their fortress of Brannibor—the first mention of the future Brandenburg,—annexed their land, and formed it into a border area, or march, under the care of a warden.

"Vehemently Heathen"

The Wends did not tamely submit to the extinction of their liberty, and in the furious revolt of 1023 what Carlyle calls the "first shadowy line" of wardens, those of the Wittekind race, vanished. Thereupon the "second shadowy line," those of Ditmarsch-Stade, of Angle or Saxon blood—who held the northern mark of Salzwedel—restored order in a fashion, until they, too, died out about 1130, making way for the hereditary line of Ascanian Margraves.

To the east of Brandenburg, five hundred miles or more, the land was peopled by a nondescript horde of Wends, Letts, Goths and others, called Borussi, or Prussians, from whom the country (now the provinces of East and West Prussia) received its name. The folk were fishers, shepherds, and amber-diggers, but, above all things, "vehemently heathen." As such, they were the objects of greatly misplaced compassion, and in 997 Bishop Adalbert of Prague suffered martyrdom near Pillau in an attempt to convert them, his fate only serving to fan missionary zeal to whiter heat, helped, on the secular or military side, by Boleslas I. (1018) and later Polish kings.

Albert the Bear (1134–70)—so styled from the heraldic device on his shield—the first and ablest of the Ascanian Margraves and the real founder of Brandenburg, reduced the Wends and colonised much of the land with settlers from North Holland driven from their homes by an inroad of the sea. These elements—Germans, Wends, Dutch and Lower Saxons—with thousands of Huguenot immigrants at a later date, furnished the staple stock of a population notoriously industrious and thrifty.

"An Entirely Worthless Herr"

The outstanding fact in Albert's reign was the advance of the Margravate to the status of Electorate, the Kurfürst, or Elector, of Brandenburg being henceforth one of the seven Electors, whose duty it was (among other things) to choose the Kaiser of the Holy Roman Empire.

Albert's successors, on the whole, displayed less capacity for government, and undid most of the constructive work he had accomplished. The habit of splitting up their territory to provide appanages for younger sons inevitably led to the curtailment of the main area, and when the Ascanian line ceased (1320) Brandenburg had lost much of the influence it had acquired.

After the Ascanian line there ensued a brief rule of Electors of the Bavarian family (1323–73), who did no good to Brandenburg. The third and last of them, Otho—in Carlyle's words, "a dissolute, drinking, entirely worthless Herr"—sold the Electorate and Mark for £30,000 to the Emperor Charles IV., who then introduced the shorter and still feebler administration of two members of the House of Luxemburg (1373–1417). Of these Electors, Wenceslaus, becoming King of Bohemia, as well as Emperor, in 1378, handed over the Electorate to his elder brother Sigismund, only reserving the Neumark portion (Brandenburg east of the

Oder) for his younger brother John. Sigismund, who also wore the Hungarian crown through his wife (1387), launching out on extravagant courses, pawned his share of Brandenburg to his cousin Jobst, Margrave of Moravia.

Jobst tried to govern for a while, but finding the country in a condition of anarchy, alienated some of the domains, connived at land robberies by others, and retired to Moravia (1390). Lawlessness grew general, and Sigismund pawned the Neumark (which had fallen in on his brother's death) to the Teutonic Order about 1398. Jobst, returning from Moravia at this date to watch his own interests, seeing things were become hopeless, cut his money loss, sold what further land he could, repawned Brandenburg to William, Margrave of Meissen in Saxony, and cleared out.

The Teutonic Knights

It looked as if Brandenburg must either be carved into pieces, which might or might not be joined on to other States, or revert into waste, when relief came unexpectedly. Sigismund was elected Emperor in 1411, in succession to Rupert, who had succeeded Wenceslaus (deposed in 1400). He owed his election to the staunch support of Frederick VI., Burgrave of Nuremberg and Count of Hohenzollern, who afterwards continued to be his righthand man and purchased (1415) the Electorate of Brandenburg—land, titles, everything—for £200,000, being duly invested at Constance in 1417.

On his accession the new ruler became Elector Frederick I., and brought with him his rights in the Franconian principality of Culmbach, which comprised the margravates of Ansbach and Bayreuth, which, at a later date, were held by younger members of the family (usually second and third sons), the eldest holding the Electorate. With the advent of the Hohenzollerns the fortunes of Brandenburg at once began to mend.

Meanwhile, Prussia had prospered under the Teutonic Knights. Marshes were drained, the soil was cultivated, and Marienburg, Memel, Danzig, Thorn, Königsberg, and other towns were founded. But the Knights now rapidly deteriorated morally, their control of the country slackened and, getting embroiled with Poland, they suffered a disastrous defeat at Tannenberg (1410). Their oppressions reached such a height that, at length, the principal towns confederated with Poland to throw off the Order's yoke and swore fealty to the Polish king (1454). Relentless warfare followed for several years, but the Knights finally agreed to the Treaty of Thorn (1466), under which Poland obtained West Prussia, and the Knights had to be satisfied with East Prussia, and do homage even for that.

Frederick I. (1415–40), after an arduous reign spent in educing order out of chaos, was succeeded in the Electorate by his second son, Frederick II. (1440–71), whose chief exploit was to redeem (1455) Brandenburg Neumark from the Teutonic Knights, then hard pressed for money. The third Elector, Albert "Achilles" (1471–86), third son of Frederick I., who had given him Ansbach, having also survived his eldest brother, John "the Alchemist," who had held Bayreuth, thus acquired the united heritage of Brandenburg and Culmbach, and was the direct progenitor of all coming Hohenzollern Electors of Brandenburg and Princes of Culmbach.

Albert's eldest son, John "Cicero," followed him in the Electorate (1486–99), and left two notable sons—Joachim I. (1499–1535), who succeeded him, and Cardinal Albert, Elector-Archbishop of Mainz, the stout upholder of Pope Leo X. and patron of Tetzel on the latter's tour to sell indulgences.

Succession Questions

His son, Joachim II. (1535–71), to the joy of his subjects, publicly avowed his adhesion to the Protestant cause (1539), and never looked backwards. He executed two deeds of significant value to his house. He induced Sigismund I. of Poland, whose daughter Hedwig became his second wife, to consent to an agreement (Lublin, 1568) under which the right to the reversion of Prussia should fall to him and his posterity in the event of the Culmbach line of Duke Albert of Prussia's failing of heirs, as was probable. The other deed was an instrument of "Heritage Brotherhood" (1537) with Frederick II., Duke of Liegnitz in Silesia, whereby on the failure of either line the other should succeed to the estates and, to ensure the compact, the eldest son on each side should, so soon as possible, marry a princess on the other. The double marriages were solemnised in 1545.

When Ferdinand, King of Bohemia, heard of the transaction, he required Frederick to cancel it, the Bohemian States and the Emperor Charles V. sustaining him. Frederick yielded (1546), and died next year broken-hearted. By a codicil to his will, however, he pronounced the compact valid as he had annulled it under compulsion. Ferdinand next addressed a similar request

From the painting by W. Camphausen.

THE GREAT ELECTOR,

Frederick William of Brandenburg (1640–88), who so greatly increased the importance of the House of Hohenzollern that his son was able to change his style from that of Frederick III., Elector of Brandenburg, to that of Frederick I., King of Prussia (1688–1713).

to Joachim II., who flatly refused to surrender the deed, as did his successors.

During the Electorate of John George (1571–98), who had married, as we saw, a daughter of Duke Frederick II. of Liegnitz, the Culmbach estates fell home, whereupon he founded the new or younger line, assigning Bayreuth to Christian, his second son, and Ansbach to Ernest, his third. He also settled, by the Bond of Gera (1598), that the Electorate was never to be divided, the law of primogeniture to apply to it in full force; and that only the Culmbach territory, if otherwise unoccupied, could be split up for younger sons into Bayreuth and Ansbach, but no farther in any case.

His successor, Joachim Frederick (1598–1608), closely watched the agreement affecting the heritage of Prussia. To establish the family influence in the duchy, his eldest son had been married (1594) to a daughter of Albert Frederick the Insane, the second Duke of Prussia, and to make the position still stronger the Elector himself, now a widower, married another of the daughters in 1603, and two years later became guardian of Prussia and its duke.

Thirty Years War

Albert Frederick had succeeded in 1568, at the age of fifteen, but in five years fell into hypochondria, which gradually grew chronic. He was already married (1573) to Maria Eleonora, the eldest daughter of William, Duke of Cleves, who also held the duchies of Jülich and Berg, and the counties of Mark and Ravensberg. This marriage disclosed alluring possibilities to the Elector of Brandenburg, as the bride was heiress presumptive to the whole of the estates, teeming with wealth, of her father, who died in 1592. She died in May, 1608, and two months later Joachim Frederick was gathered to his fathers, and John Sigismund (1608–19), who had married Albert Frederick's daughter, reigned in his stead.

On her sole brother Duke John William's death without heir (1609), the Brandenburg title was clear, but not indisputable nor undisputed. Numerous claimants appeared, the two strongest being the Elector and Wolfgang, son of the Duke of Neuburg.

The matter demanded immediate attention, for the claimants were eager and the issue was embittered by the fiercest religious rancour. As a Roman Catholic, the Emperor Rudolf II. would not hear of a Protestant duke. On his part, John Sigismund, to gratify the Dutch and the Jülichers, incurred the displeasure of his subjects by declaring himself an adherent of Calvinism, which continued from that time to be the creed of the Court of Brandenburg, while the people mainly have continued staunch Lutherans; while, to curry favour with the Emperor, Neuburg perverted to Rome. Compromises were attempted in vain and religious controversy waxed hotter and hotter. The Emperor was bent upon winning back Europe to Rome, and so the Continent was ruthlessly plunged into the miseries of the Thirty Years War (1618–48).

Hardly had war broken out when the imbecile Duke of Prussia died, and the Elector at once took steps to obtain peaceable possession of the duchy, though homage to Poland did not cease until 1657, when the duchy became irrevocably Prussian. The Elector died on December 23, 1619.

The Great Elector

As to the succession trouble, a temporary truce was agreed to in 1624, when Neuburg got Jülich and Berg, and Brandenburg Cleves, Mark and Ravensberg. In 1666 this bargain was ratified, with the proviso that if either line failed, the other was to enter, every collateral claim being barred. But a final decision was reached only in 1815, when the Congress of Vienna assigned to Prussia all the territory originally claimed in 1609.

As it happened, in this European crisis Brandenburg was governed by George William (1619–40), the least capable of the Hohenzollern Electors. He was obsessed with a policy of almost abject neutrality, and consequently Brandenburg lost most of Pomerania—its towns were sacked, the country was harried and occupied by foreign troops, and its people were driven to despair. But a feeble prince may leave a strong son, and in Frederick William (1640–88), the Great Elector, Brandenburg got the ruler her extremity demanded. With infinite patience he cleared the country of the Swedish soldiers who had been living on it, replenished the exchequer, and trained an army of excellent soldiers.

The Peace of Westphalia (1648) brought him small comfort, however. The Swedes retained West Pomerania, and the Elector had to be content with East Pomerania and the secularised bishoprics of Halberstadt, Minden, Kammin, and Magdeburg. He was obliged to assist the Swedes in their war with Poland (1655–60) to prevent East Prussia from being crushed between them, but, guided by self-interest, he adroitly changed sides and effected the Treaty of Wehlau (1657)

with the Polish King, John Casimir, which bound him to an alliance against the Swedes in exchange for the repeal of Polish suzerainty over the duchy. He got level with the Swedes by his crushing victories at Fehrbellin (1675) and near Königsberg (1679), yet his hopes for the restoration of all the Pomeranian territory were frustrated by the Treaty of St. Germain-en-Laye (1679), for Louis XIV. insisted that the tracts he had that of Frederick I., King of Prussia (1688–1713). His troops had rendered valiant service, especially in the campaigns against Louis XIV., then at the height of his absolutism, which led up to the Treaty of Ryswick (1697), and the Emperor Leopold I. could not refuse to advance their master to the higher rank. He was crowned at Königsberg in 1701, and his accession was recognised in the Treaty of Utrecht (1713).

From the picture by A. Menzel.

FREDERICK THE GREAT (1740–86),
the ablest and most unscrupulous of the Hohenzollern princes, who raised Prussia to the pinnacle of her military fame, receiving the homage of his people.

recovered must be handed back to his (Louis') faithful allies, the Swedes.

Though the Elector fought his hardest when necessary, he had no liking for warfare. He devoted himself to fostering the agricultural and industrial prosperity of his country, giving personal supervision to this work whenever he could. He built the canal called after him connecting the Oder and the Spree (1662–68), and offered a welcome and home to 20,000 Huguenots after the revocation of the Edict of Nantes (1685). This far-seeing man was the first to grasp the possible supremacy of Prussia.

His son earned fame, inasmuch as he succeeded in changing his style from that of Frederick III., Elector of Brandenburg, to

The second Prussian King, Frederick William I. (1713–40), differed from his father in the simplicity of his tastes, his frugal habits and his disrelish for cultured society; but he doted on the military, and had a mania for regiments of giants. In the only war in which he engaged he was instrumental in recovering from the Swedes West Pomerania with Stettin (1720), a success which the Great Elector had laboured in vain to compass. He left a fine army of 84,000 seasoned soldiers, a well-filled exchequer, a kingdom of some 45,000 square miles in area, and a population of two and a quarter millions.

In other words, Prussia was ripe for her creator.

Although Charles Frederick II., commonly called Frederick the Great—the "Charles" never came into use—(1740–86) had been a devotee of literature and philosophy, the disciple of Voltaire, and a fervent admirer of French ideas, he put aside his studies when he ascended the throne and turned his attention, as to the manner born, to affairs of the State. The guiding principle of his life was the exaltation of Prussia (*Preussen über Alles*), and he meant to realise his hopes by means of a rule as personal and despotic as that which had raised Louis XIV. to the pinnacle of fame.

Seven Years War

The young king soon showed his teeth. He decided to ignore the Pragmatic Sanction—under which the Emperor Charles VI., in 1713, in default of male heirs, had assigned the succession to his own daughters in preference to Joseph I.'s, who had had the priority in a pact arrived at ten years earlier—unless Maria Theresa purchased his support by the cession of Silesia. This she refused to do, and Frederick, promptly taking the field, defeated the Austrians at Mollwitz (1741), and joined the league against Austria. Next year he beat them again at Czaslau, whereupon the Empress surrendered Lower Silesia, Glatz, and a large part of Upper Silesia, in terms of the Treaty of Berlin (1742).

Maria Theresa could not get over the loss of her dominions, and Frederick's perfidy in breaking the treaty led to another, the second, war for Silesia, in which Frederick won the battles of Hohenfriedberg and Soor and conquered Saxony, which forthwith made peace (1745). Austria now reaffirmed the Treaty of Berlin, and Frederick recognised Maria Theresa's husband, Francis I., whom she had married in 1736, and who had been elected Roman Emperor in succession to Charles VII. Meanwhile, the existing coalition of Britain and Austria against France and Prussia was replaced by an amazing union between the ancient rivals of Habsburg and Bourbon.

Maria Theresa, who hated Frederick as heartily as she longed to recover Silesia, desired that the two houses should bury their feuds and combine to crush the growing power of Prussia. This situation precipitated the Seven Years War (1756–63), which left Frederick in undisturbed possession of Silesia.

No sooner was the war over than Frederick went vigorously to work to restore the industries, finances, and social condition of the kingdom, which he had transformed into one of the five Great Powers of Europe.

Frederick's nephew, Frederick William II. (1786–97), succeeded him. He was a weak, unstable prince who threw away much of the prestige which his uncle had won.

Prussia lost further caste under her next king, Frederick William III. (1797–1840). He very strongly disapproved of Napoleon's occupation of Hanover (1803), but lacked courage to join the coalition of the Powers against France. At last, when a French army passed through Ansbach, and violated its neutrality, he was shamed into action.

The league drew up the Treaty of Potsdam (1805), in which Prussia agreed to demand of Napoleon the evacuation of Piedmont, Switzerland, and Holland. Austerlitz followed hard upon this brave document, and instead of pressing any demand on the conqueror, the latter compelled Prussia to sign the Treaty of Schönbrunn, by which Neufchâtel and part of Cleves were resigned to the French and Ansbach was ceded to Bavaria, while Prussia was formally allied to France. In exchange, Prussia was to get Hanover, but was to shut out British ships from North Sea harbours. Napoleon, however, had overreached himself.

The Continental System

On Fox's accession to office Napoleon deemed it possible to secure the neutrality of Britain by an offer to restore Hanover. This came to the ears of Frederick William and satisfied him that he had been Napoleon's cat's paw, and he declared war against France. But his mean-spirited neutrality had alienated the Powers, and he was without an ally. Jena (1806) effectually disposed of the Prussian attack; fortress after fortress capitulated, and Brandenburg was overrun.

Under these blows Frederick William revealed unsuspected nerve. He withdrew to East Prussia to continue, along with Russia, war to the knife, while Napoleon from Berlin fulminated the edict (November 21, 1806) proclaiming his Continental System. The battles of Eylau and Friedland (1807) led to the retreat of the Russians and to Alexander I.'s interview with Napoleon at Tilsit. By the treaty Frederick William III. was to resign all of his kingdom west of the Elbe (to constitute Westphalia for one of Napoleon's puppet-kings, his youngest brother Jerome), and the territory acquired in the second and third partitions of Poland, while the rest of the kingdom was saddled with the payment of a huge indemnity to France.

J. A. M.

Continued from page 140.

SCIENCES:

***Contributors*:—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).**

BOTANY.—XXIII

70. Apetalæ.—We have noticed in our descriptions of the preceding orders that certain genera have apetalous flowers, in which the calyx has taken on the function of the corolla. There are, however, several common orders in which the perianth is reduced to very inconspicuous rudiments, and others in which it is completely suppressed. In all these cases, the flowers are individually small, but atone for this by their number; they are usually wind-pollinated; or if adapted to insect pollination it is by the enlargement of accessory parts like the bracts of the spurges. Self-pollination also occurs frequently among these families, and many of the species are common weeds everywhere.

Fig. 175.—Sun Spurge (*Euphorbia helioscopia*).

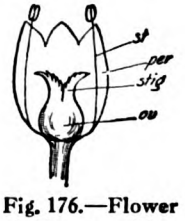


Fig. 176.—Flower of Common Elm.

The weedy plants of **Chenopodiaceæ,** including the genera *Chenopodium* (Goosefoot, Good King Henry) and *Atriplex* (Orache), are common everywhere, with their small green flowers in spikes, sometimes monœcious. The **Polygonaceæ** include *Rumex* (Dock) and *Polygonum* (Knotgrass), very familiar in all waste places, recognisable by their triangular fruits and ochreate stipules. The **Euphorbiaceæ** include *Mercurialis* (Dog's Mercury) and the many species of *Euphorbia* (Spurge), as well as *Buxus* (Box). The spurges have a peculiar inflorescence called a cyathium, in which a number of male and female flowers, each with tiny perianth subtending it, are enclosed in a very large involucre—the whole springing from the axil of another bract. The nettle family, **Urticaceæ,** has also very small flowers, monœcious or dicecious, with a perianth 4 or 5-cleft. *Humulus* (Hop) belongs also to this order and has catkin-like inflorescences.

The order **Ulmaceæ** contains the elms—*Ulmus campestris* (Common Elm) and *Ulmus montana* (Wych elm)—among the commonest of our trees.

Of the two Elms, the Common Elm is most frequently seen in the South, and the Wych Elm in the North. The latter has larger leaves and fruits, and generally develops more broadly at the summit. Otherwise the two trees are very similar. It is said that the seeds of the Common Elm do not develop in Britain; in any case it is propagated mainly and readily by means of suckers. It is a rather scraggy

Fig. 177.—Male catkin of Goat Willow.

Fig. 178.—Female catkin of Goat Willow.

tree, owing to the growth on its bole and branches of shrubby stems from long-dormant buds. The flowers occur in numerous clusters; each flower has a tubular perianth, five-lobed, with a stamen corre-

sponding to each lobe, and the fruit is an oblong samara.

71. Salicaceæ. — The plants whose flowers have no perianth at all are all trees, and include many of our most familiar types. Two main groups will be mentioned here: the *Amentiferæ* or catkin-bearers, and the *Coniferæ* or cone-bearers. Of the former we shall deal with three orders which are readily identified.

The Salicaceæ include the two genera, *Salix* (Willows) and *Populus* (Poplars). In this order the catkins are diœcious, i.e. the male and female grow on separate trees. A catkin is really a spike, consisting of a

Fig. 179.—Female catkin of Aspen (*Populus tremula*)

large number of very simple flowers, each growing from the axil of a bract or scale-like leaf.

In the Willows, the male catkin is oval, about an inch long, and when quite mature of a conspicuous yellow colour. The scales have a covering of silky hairs, and from each come 2-5 stamens with long filaments. The female catkin is similar in shape and size, but not quite so conspicuous; in each axil there is a single tapering ovary on a stalk, and two conspicuous stigmas are present. In contrast with other Amentiferæ, the Willows are pollinated by bees, and nectaries are found at the base of each carpel or stamen. The fruit is a capsule with valvular dehiscence; the seeds, attached to the inside of the capsule along two lines, are numerous, and each covered with silky hairs for wind dispersal.

Fig. 180.—Male and female inflorescences of Pedunculate Oak.

The various species of Willow are not always easy to distinguish, and some of them are little more than varieties. All thrive well near the water side, and grow very rapidly into long, straight and pliant twigs (osiers). To encourage this growth, the useful species have their main trunks and branches cut down (Pollard Willows). *Salix fragilis* (Crack Willow) has narrow leaves and is a common tree, so named from the ease with which its twigs will break off. *Salix alba* (White Willow) has narrow leaves with silky hairs on the underside. *Salix caprœa* (Sallow) grows into a large tree, but is more familiar in hedgerows. It has broad leaves, as also has *Salix pentandra* (Bay-leaved Willow), a smaller tree. *Salix triandra* (Almond-leaved Willow) is somewhat similar to the Crack Willow in size and appearance; and *Salix viminalis* is the common osier, with long silky leaves.

Of the Poplars, four species are common. In each, the catkins are long and pendulous, and produce in the female an abundance of hairy seeds, which are conspicuous on both the Black and White Poplar in June. The Poplars have ovate leaves with deeply toothed or wavy margin, and long flattened petioles which make them tremble in the slightest wind. This last feature is especially marked in the Aspen tree (*Populus tremula*). The White Poplar or Abele (*P. alba*) is easily recognised by its leaves, which are bright green on the upper and quite hoary on the under side. The leaves of the Black Poplar

Fig. 181.—Birch diagram of Male Scale.

Fig. 182.—Birch diagram of Female Scale.

(*P. nigra*) have not this appearance; moreover, the bark is rougher and darker. Both grow rapidly into fair-sized trees. The spire-shaped Lombardy Poplar (*P. fastigiata*) is not a native, and does not produce seeds in Britain; its form is due to the upward turn of all the branches.

72. Cupuliferæ.—The trees and shrubs in this order differ from the Salicaceæ in having monœcious catkins and in having their fruit (achene) partially or wholly enclosed in a *cupule*, formed from the bracts.

The Hazel (*Corylus*) has been referred to (Vol. V., p. 323), and it may be taken as typical of the Cupuliferæ. The male catkins are pendulous; each scale bears in its axil two smaller scales, from which the stamens arise. The female catkins are bud-like with red stigmas. The cupule is at first a very tiny growth at the base of the ovary, but enlarges rapidly as the nut is formed and ends as the familiar cup of the filbert.

The Beech (*Fagus sylvatica*) is one of our most familiar forest trees, remarkable for the dense shade cast by its spreading branches when it is in full leaf. Its catkins are spherical; the male drooping like tassels; the female standing more or less erect on the same branch. They are to be looked for on older trees just about the time of leaf-opening; they often escape observation because of their position. The female flowers have a triangular ovary with three stigmas, and two or three of them are completely enclosed in the large spiny cupule, which dehisces and sets free the nuts.

The Oak (*Quercus*) should also be examined for its catkins about April or May. The male are pendulous, with scattered and not compact flowers. The female are bud-like, one-flowered, and yield the acorn with its cup-like cupule.

The Hornbeam (*Carpinus*) is sometimes mistaken for the Beech, but is very different in its flowers and fruits. The male catkins

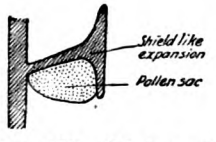


Fig. 183.—Diagram of Male scale from Pine.

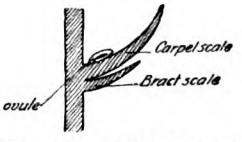


Fig. 184.—Diagram of Female scale from Pine.

are pendulous, and the nuts are enclosed in an involucre which in this case is prolonged into a characteristic wing.

The Spanish Chestnut (*Castanea vulgaris*) belongs also to this order: its long drooping catkins bear both male and female flowers at different parts. The cupule is large and prickly.

Betulaceæ.—The two common genera of this family might be included in the Cupuliferæ, but the cupule is not obvious and plays no important part in the fruit. The whole female catkin enlarges and hardens into a woody cone, from which the light fruits with their cupule drop out.

The Silver Birch (*Betula alba*) is easily recognised under any circumstances by its white scaly bark and its light graceful branches. The catkins appear in April, the male long and pendulous, the female smaller, but of the same shape, and erect. Each scale of the male catkin subtends four subsidiary scales which have each two stamens in their axils. The female scales bear two carpels, each having two stigmas (Figs. 181, 182). The fruit is a samara.

The Alder (*Alnus glutinosa*) is a pleasant tree especially fond of wet places and quite common along streams. The tree is laden with the pendulous male catkins in March, or even earlier; the smaller female catkins are not so noticeable until, after fertilisation, they have produced the woody cones.

73. Coniferæ.—This great order is the chief group of Gymnosperms, i.e. of plants

Fig. 185.—Leaves of Scotch Pine.

Fig. 186.—Leaves of Silver Fir.

whose seeds are borne naked and not enclosed in fruits. They are for the most part natives of exposed or mountain regions; consequently their leaves are much reduced in area and have other adaptations for the avoidance of excessive transpiration. The flowers are formed always in cones. In the male cones, we have simply a number of rude stamens. Taking the Common Pine as our example, we find each scale to end in a shield-like expansion, and underneath the scale we have two pollen-sacs; there are no accessory scales. In the female cone, the scales occur in pairs; the upper one bears the two ovules naked on its upper side, and should probably be regarded as an unclosed carpel; the lower one is a bract scale, which

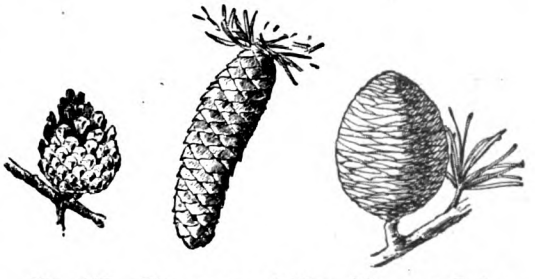


Fig. 187.—Ripe cones of Pine, Fir, and Cedar.

fuses with the carpel scale after fertilisation to form with it the woody scale of the ripe cone.

The Pines (*Pinus*) can be distinguished from the Firs (*Abies*) in several ways. The leaves of *Pinus* are acicular, and are borne in clusters of 2-5 on dwarf shoots only; the leaves on the main stem and its branches are scale leaves only. Those of the Firs are short and flattened, and arise from the main

axes. The mature cones also are of different shape, those of the Fir being longer, more flexible and drooping (Fig. 187).

The Spruce Fir (*Picea excelsa*) has leaves of the same shape as those of the Silver Fir (*Abies pectinata*), but they have a quadrangular instead of elliptical section.

The Larch (*Larix europœa*) has acicular leaves which are deciduous annually, unlike those of other Coniferæ. Its purple cones (♀) are very familiar objects in springtime.

The Cedars (*Cedrus*) are handsome trees whose long acicular leaves are borne in clusters on the main axes. The mature cones are more compact, the scales overlapping more completely than in *Pinus*.

The Juniper (*Juniperus*) is, like Pinus, a native conifer in Britain. Its female cones have few flowers (three), of which the scales become fleshy in the fruit, forming the so-called berry. The leaves are small and prickly, and arranged in whorls of three.

Like the Juniper, the Cypress (*Cupressus*) has very small leaves, reduced to little more than green scales arranged in rows along the stem. The ripe cones are small and spherical, with few scales.

The Yew (*Taxus*) is a familiar tree, which differs from other Coniferæ in being diœcious. The male cones are like buds, but have numerous rude stamens and are numerous enough themselves to make the male trees conspicuous. The female flower has only one ovule; a small dry seed results (not a cone), which is almost enclosed in a red succulent aril—a specially developed structure, and not a bract.

Other Coniferæ not uncommonly seen are the Arbor Vitæ (*Thuja*) with small leaves and flattened branches; the Monkey-puzzle (*Araucaria*) whose closely-set whorls of leaves have sharp spiny tips; and the Maidenhair tree of Japan (*Ginkgo*) whose leaves are fan-shaped and which has several very primitive points of structure.

74. Other Trees and Shrubs.—We here make brief mention of a few further common trees and shrubs not included in the orders previously mentioned.

The Ash (*Fraxinus*) belongs to the same order as the Lilac, viz. Oleaceæ. It is a large, handsome, fairly symmetrical tree, easily recognised by its ashen-grey twigs with their small black buds, by its pinnate leaves in opposite pairs, and by its one-winged samaras. The flowers occur in compact clusters immediately beneath the terminal buds, and appear in April before the leaves. In the Common Ash there is no perianth, though both sepals and petals occur in the Manna Ash (*F. ornus*). The flowers are either hermaphrodite, female or male; and trees may be monœcious or diœcious. There are two stamens and two carpels.

The Sycamore (*Acer pseudo-platanus*) belongs to the same order (*Aceraceæ*) and genus as the Maples (*Acer campestris*, etc.) which it resembles in many ways, especially in its decussate pairs of palmate leaves and its fruits (samaras). The flowers are individually small, but are grouped into large drooping inflorescences which are very conspicuous; their formula is K5, C0, A8–10, $\underline{\underline{G}}$ [2], and there is a very noticeable disk. Some of the flowers, however, are incomplete; even a whole inflorescence may contain male flowers only.

The Plane (*Platanus*) superficially resembles the Sycamore; but its leaves, though of similar shape, are alternate; its bark peels off in patches; its inflorescences are spherical and consist of ♂ or ♀ flowers only; and its fruits are like hard balls containing a number of nut-like fruits.

The Horse-Chestnut (*Æsculus*) belongs to the order Sapindaceæ, and really has nothing in common with the Chestnut proper. It may be recognised by its digitate leaves in opposite pairs, its large sticky buds, its erect inflorescences of conspicuous flowers in June, and its prickly capsule. Some of the flowers are imperfectly unisexual, and are well adapted to pollination by bees.

The Lime (*Tilia*) has a cymose inflorescence, subtended by a large skinny bract; the small flowers—K5, C5, A ∞, $\overline{G}$ [5]—are fragrant, and very attractive to insects. The fruit is an achene, scattered by the bract which acts as a wing.

The Holly (*Ilex*) is familiar from its sharp-toothed leaves and its "berries," which are really four-seeded drupes. The trees are diœcious, and the small green flowers are in fours.

The Barberry (*Berberis*) generally appears as a bushy shrub, some of whose leaves have been transformed into spines. The racemes of yellow flowers are conspicuous, and the six stamens have a sensitive filament. The fruit is a red berry.

The Mezereon (*Daphne mezereum*) is a Laurel much found in gardens; it has red flowers, red berries and deciduous leaves. The Spurge Laurel (*Daphne laureola*) has green flowers in drooping clusters, and is an evergreen. E. W. E.

METEOROLOGY.—V

WHAT actually is the general relation between temperature and pressure may be summarised by the statement that *the hotter the air the less its pressure* since hot air expands and becomes less in density. The connection between pressure and humidity is expressed in the statement: *the wetter the air the lighter the pressure.* This may sound a paradox since water is much heavier than air, but it must be remembered that wet air contains water vapour which is lighter than the same volume of air. Thus a mixture of air and water vapour weighs less than an equal volume of dry air alone.

This may be clearer if we understand that in a given volume of the mixture each par-

ticle of water vapour takes up the space which would be occupied by an air particle if no water vapour were present. Consequently when the barometer is high the pressure of relatively dry air is indicated and wet weather is generally not likely to occur. This connection between humidity and pressure has been observed for a long time, and a primitive form of weather-glass consists of an inverted glass flask containing a definite weight of air, the flask being inverted with the lower open end immersed in water contained in an ordinary glass vessel.

During fine weather, when the air is relatively dry, water ascends in the neck of the flask, and with wet weather it descends. The general principle of the mercury barometer has been explained in Vol. II., p. 225, but the meteorologist must have a fairly detailed knowledge of such instruments. The Meteorological Authorities insist on the use of either a Fortin barometer or a somewhat similar instrument known as the Kew barometer. For use on ships an apparatus of the Kew pattern is mounted on gimbals so that no matter how the ship may roll the barometer remains vertical.

Early English Weather Glass.

For accurate work at least three important facts must be noted and always observed.

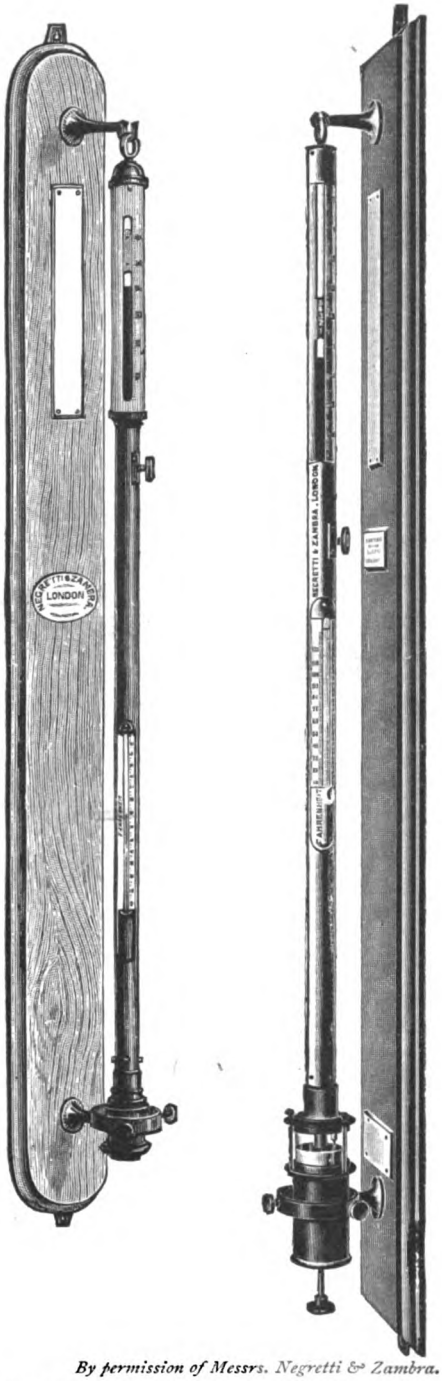
(1) The mercury column must be adjusted by turning a screw at the base until the mercury in the cistern just touches the tip of an ivory index.

(2) A sliding scale known as the *Vernier* must be adjusted until the bottom edge of the Vernier lies exactly level with the top of the mercury in the tube. This adjustment is performed by means of a screw placed near the top of the instrument and at the right-hand side.

(3) The readings obtained must be corrected by reference to tables published in such works as the "Barometer Manual of the Meteorological Office." The reasons for these corrections consist of the following :—

(*a*) Apart from pressure, temperature influences the length of the mercury column.

(*b*) Gravity varies with latitude so that



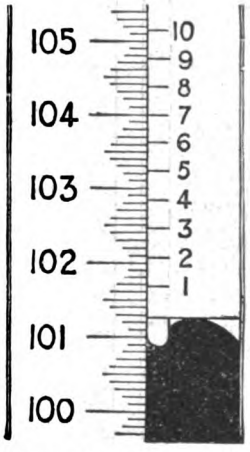
By permission of Messrs. Negretti & Zambra.

Standard Barometers : Kew pattern (*left*); Fortin pattern (*right*). The Kew barometer, mounted on gimbals, is used on ships. However much a ship may roll, the barometer remains vertical.

the weight of mercury is not quite the same at all parts of the earth's surface.

(*c*) All readings must be reduced to sea-level so that allowance must be made for the altitude of the place. The tables mentioned are quite easily used and for serious work the corrections must be made.

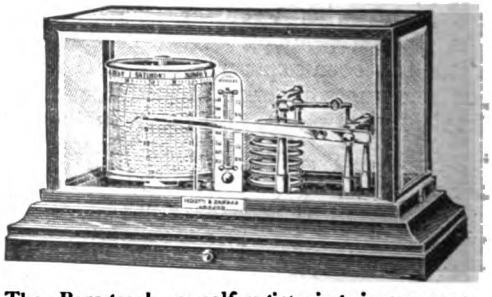
To read the barometer, having adjusted the mercury in the cistern the observer adjusts the Vernier as described above and as shown in the illustration. It is important that the observer's eye should be on the same level as the bottom of the Vernier. Next note the figures on the larger scale. In the case illustrated the top of the mercury is a little higher than 101·2, the ·2 being indicated by the smaller marks on the scale.



Illustrating the application of the Vernier scale.

Now we have to find the next decimal point. Notice which of the marks *on the Vernier* coincides with a mark on the bigger scale. That Vernier mark will give the figure of the next decimal place. In the illustration it is 7, so that the complete reading is 101·27 centibars or 1012·7 millibars. It has been the custom to express the height of the barometer in inches, but the more up-to-date method employs units called millibars. These have been introduced in order to conform with other scientific units of what is called the *centimetre-gramme-second system* (C.G.S.). In this system the unit of pressure is the dyne per square centimetre, but this is so small that a unit equal to one million dynes is employed. Meteorologists call this unit a "bar," and it is equal to the pressure of 29·3 inches of mercury and of course to one thousand millibars. *The average atmospheric pressure at sea level is equal to* 1016 *millibars, or* 30 *inches of mercury.* A modern barometer such as the Kew instrument gives the readings in either inches or millibars. Reference should be made to the weather chart, Vol. II., p. 290, where both inches and millibars are used.

Although, it must be remembered, mercury barometers must be used in connection with work done for the Meteorological Office, another class of instrument in which no mercury is employed is very useful on account of its portability. In an *aneroid* barometer air in a state of partial vacuum is enclosed in a shallow metallic box. If the air pressure increases the surfaces of the box are pushed slightly inwards, but if the pressure decreases the surfaces move slightly outwards. These movements of the box can be communicated to a pointer which moves up or down a scale as the case may be. The ordinary weather-glass hanging in the hall works in this way. An extremely useful self-registering instrument of the aneroid type is known as the barograph.



The Barograph, a self-registering instrument of the aneroid type.

In this instrument, multiplication of the movement is obtained by the use of several metallic boxes placed one above another. The movements of these boxes, due to changes in air pressure, are communicated to a lever having a pen at the remote end. By this means, a graph or line is traced on paper carried on a drum actuated by clockwork. One piece of paper is sufficient for a week's record. It may be noted in passing that whereas the self-recording thermograph must be open, the barograph is usually enclosed in a glass case. Small pocket aneroid barometers are of much use particularly in connection with observations on altitude. The atmospheric pressure decreases by ·1 of an inch of mercury for every 90 feet of ascent, so that an observer may calculate the height of a mountain or of a balloon by noting the atmospheric pressure and making a simple calculation.

Since air is a very elastic fluid a wind will blow from a place where the air pressure is higher, to a district where the pressure is lower. It is not necessary for either of these pressures to be high, provided there is a difference. The direction of winds may be deduced from an isobar map, which also supplies information with regard to the approximate force of the wind. The velocity

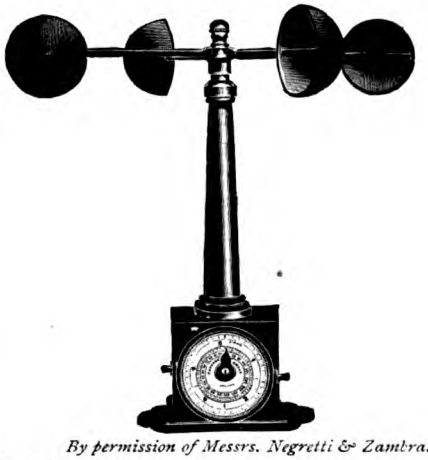
Drawn by H. W. Koekkoek.

IN THE TRACK OF A TORNADO

which, travelling at 77 miles per hour, struck and in two minutes almost demolished Meridian, Mississippi. Tornadoes, typhoons, hurricanes and cyclones are synonymous; they are all cyclostrophic winds, known by different names in different regions (*see* **also p. 268**).

and force of a wind is intimately connected with what is known as the *barometric gradient.* Just as the slope of the ground may be expressed as a gradient of, say, one foot in a thousand, so the change in air pressures at two distant localities may be expressed as a gradient of, say, two hundredths of an inch in the horizontal distance between the two places.

Suppose this distance to be thirty-four miles, then the barometric gradient is said



By permission of Messrs. Negretti & Zambra.

Cup-Anemometer, an instrument for measuring wind velocities.

to be 1· since *gradient is expressed in hundredths of an inch of mercury per fifteen nautical miles,* the latter being equivalent to seventeen land miles.

Take another example. Suppose the distance between two places to be 68 miles and the difference of barometric pressure to be ·12 of an inch, then the gradient is 3. With this gradient there would be a wind described as " a strong breeze " travelling at the rate of about twenty-five miles per hour.

The velocity of the wind does not increase in direct proportion to the gradient, since a gale travelling at fifty miles an hour corresponds to a gradient of 7, not 6. Now *the relative positions of isobars on charts give some idea of the gradient.* If the isobars are close together, then the gradient is steep and the winds have a relatively high velocity, because closely packed isobars represent considerable change in air pressure in a short horizontal distance. Conversely, large spaces between the isobars indicate low gradients and more gentle breezes. In which part of the area represented by the Cyclone chart in Vol. II., p. 292, is the barometric gradient steepest and the winds strongest ?

The velocity of the wind is determined by instruments called *anemometers,* of which there are three classes.

(1) pressure anemometers,
(2) those using a wheel rotated by the wind and
(3) relatively modern appliances which may be termed suction anemometers.

The first class includes the earlier forms of apparatus used for this purpose, and it is probable that the first of the kind was introduced about the middle of the seventeenth century. This early form consisted of a wooden plate at the end of a rod attached to a horizontal axis. The wind blew the wooden plate through an arc of a circle, and the greater the velocity of the wind the greater the angular distance through which the plate moved.

Robinson's Cup-Anemometer

This consists of four hollow cups mounted at the extremities of two horizontal arms intersecting at right angles. The base of one cup always faces the opening of the next, and the result of this is that whatever the direction of the wind the arrangement is caused to rotate on a vertical axis. The rotation of the axis is, in the older instruments of this class, communicated to wheels which operate a hand on a dial, thus indicating the wind velocity.

In a more modern type of a similar apparatus the speed of rotation is recorded by electrical means—an obvious advantage since the recording part may be placed indoors at any convenient distance from the rotating cups situated on some high edifice. With winds of high velocity the speed of the cups is of course greater than that with more feeble winds, but the ratio of the actual speed of rotation to the wind velocity differs according to the size and construction of the anemometer. The wind velocity is usually something between two and three times the speed of rotation of the cups.

A still more modern and useful form of anemometer is known as the *Anemobiagraph,* which records direction, pressure, and velocity. This apparatus belongs to the suction class of instrument. The horizontal axis of a wind vane on this apparatus is hollow, consequently wind enters the narrower pointed end and blows down a vertical tube. The wind also blows past some small holes placed near the top of the vertical tube, thus causing a suction, and the results are manifested in alteration of pressure of the air in the tube. These variations in pressure

are transmitted by air in tubes to a distant recording instrument which traces a graph on paper mounted upon a cylindrical drum.

A little more than a century ago Admiral Beaufort formulated a scale of wind velocity which is in use at the present day.

Since wind velocity is often expressed in metres per second this item is shown on the scale quoted below.

THE BEAUFORT SCALE.

Beaufort No.	Description	Average pressure per sq. ft.	Velocity	
			Statute Miles per hour	Metres per second
0	Calm	0	0	less than ·3
1	Light air	·01	1–3	·3– 1·5
2	Light breeze	·08	4–7	1·6– 3·3
3	Gentle ,,	·28	8–12	3·4– 5·4
4	Moderate ,,	·67	13–18	5·5– 7·9
5	Fresh ,,	1·31	19–24	8·0–10·7
6	Strong ,,	2·3	25–31	10·8–13·8
7	High wind	3·6	32–38	13·9–17·1
8	Gale	5·4	39–46	17·2–20·7
9	Strong gale	7·7	47–54	20·8–24·4
10	Whole ,,	10·5	55–63	24·5–28·4
11	Storm	14·0	64–75	28·5–33·5
12	Hurricane	above 17	above 75	above 33·5

In connexion with the study of air circulation, it is very important that one should bear in mind that the actual velocity of moving air is quite different from its apparent velocity. When there is what we term an absolute calm and the air appears to be quite still, it is really travelling at exactly the same speed as the ground surface upon which it rests. Owing to the rotation of the earth on its axis, places on the surface travel at a speed which depends upon latitude, the speed being greatest at the equator. Should any disturbance take place in the air so that its speed is either greater or less than that of the ground underneath it, a wind is produced. L. M. P.

ZOOLOGY.—XXXII

THE order *Hymenoptera*, which includes the Ants, Bees, Wasps, Saw-flies and Ichneumons, is easily the most interesting group of the *Insecta*. It is the most interesting, since the ants and the bees exhibit in their communal life a degree of intelligence which is almost akin to that of man himself; it is also the most baffling, owing to the difficulty which all observers experience in determining where instinct ceases and reason begins.

If it were stated that there existed in the world a number of large communities the members of which erected elaborate habitations, kept slaves, constructed roadways, employed soldiers, conversed with each other upon matters of importance and upon occasion tended and fed their sick fellows, no one would doubt that the reference was to man himself. It might well be so, but it could with equal exactness apply to the ant.

If we read of a certain State, that its subjects toiled almost without intermission for the common weal, that to each of its citizens a specific duty was allotted, that within its boundaries no useless mouth was permitted, that the integrity of its accumulated treasure was jealously guarded, and further that its monarch, whose actions are limited by precedent, is supported to the length of death itself by every member of the community, we should consider we had here a picture of a well-organised and formidable country. But the description is equally true of every hive.

The Industrious Ant

In fact, no dispute can possibly arise as to the truly astonishing extent to which the ant and the bee have carried collective action. Differences of opinion only make themselves felt when the subject under discussion is less the wisdom of the race than the extent to which the individual ant or bee is guided by conscious reasoning.

All ants are included in one great family, the *Formicidiæ*, although this order is subdivided into numerous species. In the adult stage ants are of three forms, Male, Female, and Worker. Of these forms the male and female possess wings, which are entirely absent in the worker. The part played by the ant's wings, however, though an important one, is very brief, for the females after the nuptial flight divest themselves of these adornments and become henceforward creatures of the earth.

The ant's eyes, like those of other insects, are of two types, the compound and the simple, termed *ocelli*. The former are always extremely numerous, though the number of facets varies with different species; the ocelli are never more than three in number and, in the case of some species are altogether absent in the worker. The food of ants consists of insects and sweet matter such as honey and fruit. As with the bees so with the ants, the developed females are concerned solely with the preservation of the race, the undeveloped females or workers undertake the daily work of the community, and the males bring to a rapid end a lazy and more or less useless existence. There

is, however, this notable difference between the bees and the ants, that in the former case only one queen can reign at a time, whilst a community of ants will frequently contain several developed females.

The nature of the ant's nest varies considerably with different species, the Garden Ant makes its abode in the ground, the Turf Ant may be found occasionally under stones, the Common Black Ant forms its nest in hollow trees; still other species construct what are known as "paper nests," that is, nests formed of masticated wood dust held together in the first place by a fluid secreted from the salivary glands. Other nests are built in the fissures of walls, or are constructed from a miscellaneous collection of sticks and vegetable substances.

Different species, in short, follow different methods. But in all cases the nest consists of a number of chambers and galleries, and is provided with entrances which by reason of their narrowness can be easily guarded and closed at night. In some cases covered trenches lead directly from the nest to a favourite feeding ground.

Chivalrous Foes

Amongst human beings cities remain though the inhabitants are continually changing. So it is amongst the ants, but a complete change of residence is effected more rapidly. The life of a male never exceeds the space of a few months; females have been known to live for more than twelve months, but in normal circumstances it is doubtful if they do so; the worker may live as long as six years. It is possibly the threat of race extinction, consequent upon the short life of the individual, that induces it to display such energy and devotion in the matter of rearing the larvæ.

This duty is primarily entrusted to the young workers, who are not as yet sufficiently strong to undertake the duties of guarding the nest and foraging for food, and they appear to recognise to a peculiar extent the responsibilities of their position. Though the adults of different nests may be engaged in a warfare in which mercy is unknown, should any of the larvæ of one side come into the possession of the other, they are reared by the workers as carefully as the larvæ of their own queen. This fact is the more remarkable since ants undoubtedly recognise strangers of the same species and never hesitate in the case of adults to kill them off.

The experiments conducted by Lord Avebury with a view to testing the ant's care for its friends and its hostility to strangers are well known. Briefly, he placed near to a nest of *Formica fusca* two bottles, in one of which he confined two ants taken from the nest, and in the other two strangers of the same species. The end of each bottle was covered with muslin, which prevented the prisoners from escaping, but through the meshes of which they were plainly visible. This experiment, though often repeated, always produced the same result, the friends were entirely ignored, no attempt being made to release them, but the bottles in which the strangers were confined was continually watched by a large party of ants who eventually bit through the muslin and put them to death. The hostility of ants to strangers of their own species is, indeed, a well-established fact.

Lord Avebury's Experiments

Evidence, however, on the subject of their compassion for their friends is somewhat conflicting. In the experiment mentioned above it was seen that the friends were ignored, and this was equally the case when the distraction offered by the strangers was not operating. In another series of experiments the same authority intoxicated equal numbers of friendly and strange ants, and placed them with a supply of honey upon a slip of glass over some water in the vicinity of a nest of *Lasius flavus*.

From this nest a stream of ants soon poured to the honey, passing upon their way the bodies of their unfortunate friends and those of the strangers. The general results of this experiment, Lord Avebury tells us, were that "the ants removed forty-one friends and fifty-two strangers. Of the friends, thirty-two were carried into the nest and nine were thrown into the water. Of the strangers, on the contrary, forty-three were thrown into the water, only nine were taken into the nest, and seven of these were shortly afterwards brought out again and thrown away."

These experiments were conducted over a period of days, and to make the experiments as reliable as possible the distinguishing marks painted upon friends and strangers were alternated from time to time.

Do animals talk? The question is often asked and is usually correctly answered in the negative. As we understand the term, man alone conveys thought by the medium of speech. But if we make the question deal merely with the ability of certain animals to communicate one with another, we must reply that in some cases un-

doubtedly they do. In the case of the ant it is generally agreed that communication takes place by the medium of the antennæ, but the extent to which communication can be made has not been determined.

Lord Avebury doubted "if they possessed any considerable power of descriptive communication," but had no doubt that "they do possess some power of the kind." Dr. Landois while investigating the same question pointed out that some ants have the means of producing sounds perceptible to the human ear, by the grating of the edge of one abdominal segment over a finely striated portion of the succeeding one.

Recognition Problems

Equal difficulty is experienced by those who would explain the undoubted ability of ants to recognise members of their own nest.

It appears to be almost certain that memory plays little or no part in the matter. We have, in fact, only to remember that a nest may contain as many as 450,000 ants to see that short of the possession of very extraordinary powers in that direction no individual could possibly recognise his fellows by a mere effort of memory. Yet recognition in some form or other there certainly must be, since a stranger of the same species is instantly attacked. The matter becomes the more difficult since it has been proved by experiments that ants recognise the young of their own nest, even when they have been brought out of the chrysalis and actually reared amongst strangers.

Many of the habits of ants which at first glance appear to suggest direct communication are due to other causes. The well-known fact, for instance, that an ant which has found food will after returning to the nest be accompanied to her newly-found treasure by a number of her friends, is not an argument in favour of direct communication. Even

Photo: Dr. Alfred Gradenwitz.

AT THE MORNING TOILET.

A remarkable study of ant life, as seen through a microscope.

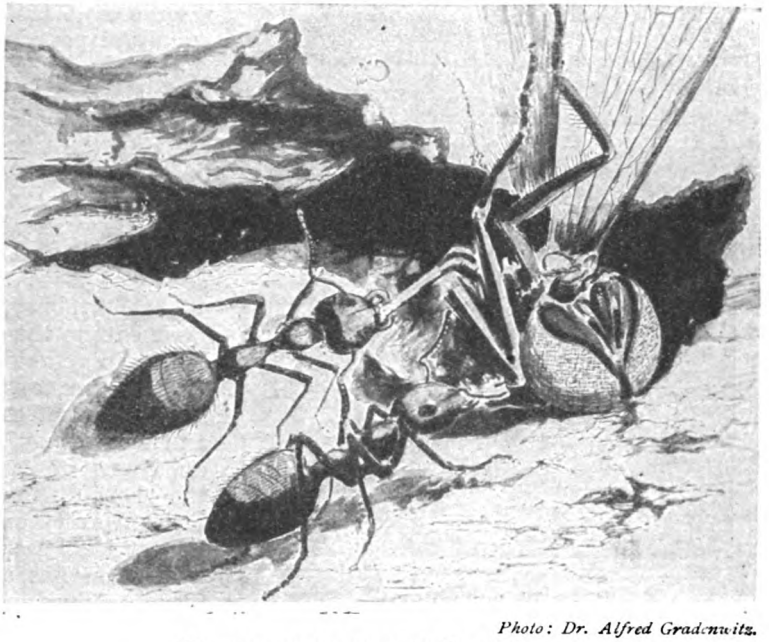
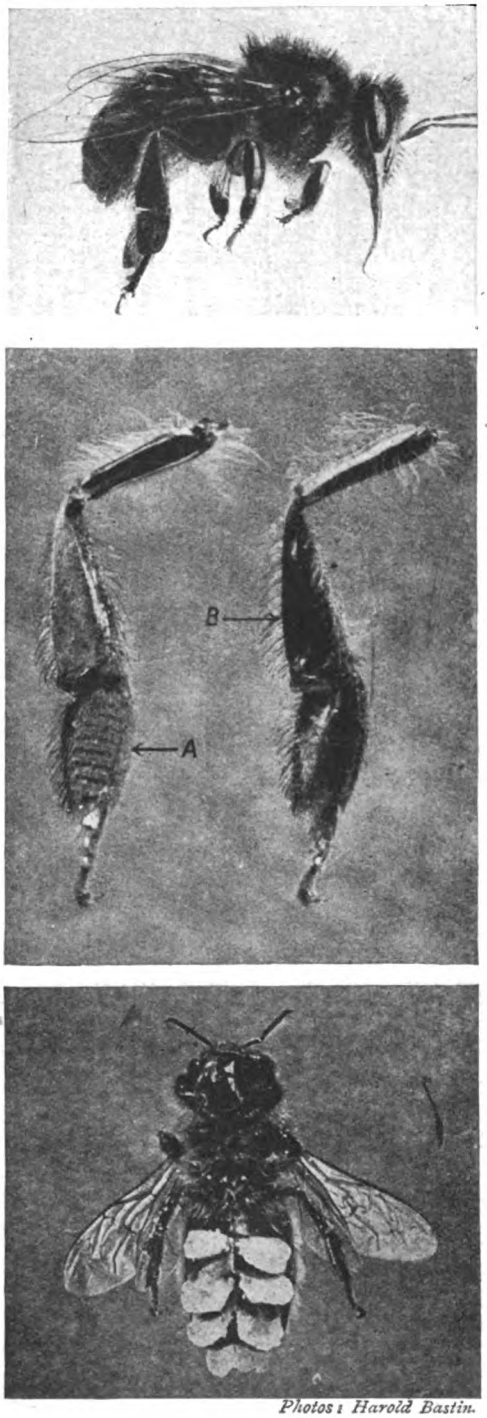


Photo: Dr. Alfred Gradenwitz.

CO-OPERATION IN THE ANT WORLD.

Much has been written about the labour-saving devices adopted by ants, but Lord Avebury's experiments tend to show that the ant's ingenuity in this respect has been exaggerated.



Photos : Harold Bastin.

THE WORKER BEE,

Showing (*top*) the tongue and hind legs; (*centre*) the hind legs magnified: A—the currycombs on the inner aspect, B—the "pollen baskets" on the outer aspect; and (*bottom*) the bee itself with wax scales protruding.

when the first ant outstrips her friends, the fact that they find their way to the food without her does not prove that she had already explained the precise situation in which the food was to be found. On the contrary, experiments seem to show that the friends in such a case are more or less guided by scent, since they will follow the track of the first ant even when she misses her way.

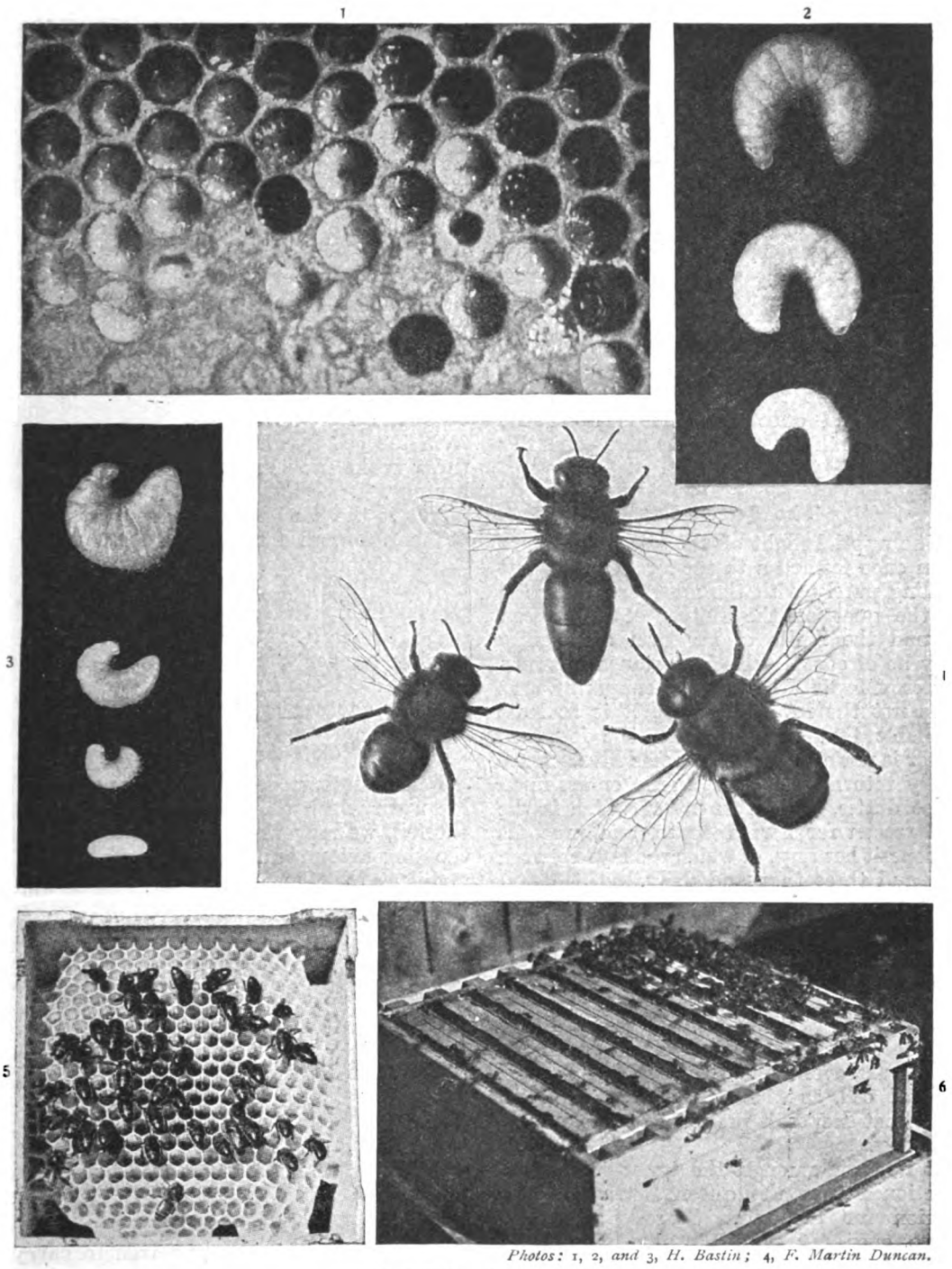
Whether the same theory of scent explains the ability of the ant to recognise the inmates of its nest is a moot point. Many authorities, however, are inclined to doubt that it can do so, since, it is argued, it is extremely improbable that every nest has its own scent. Again, this theory scarcely explains the fact already mentioned that ants recognise the young of the nest even when to all intents and purposes they have never lived in it.

Ants and Labour Saving

Many writers have dilated at considerable length upon the highly ingenious methods employed by the ant with a view to economising labour. In investigating such cases, however, it is always extremely difficult to say whether a particular action is due to exceptional causes or whether it is a typical example of reasoning power possessed by the race generally. One observer, for instance, records the fact that, having placed a large supply of pounded sugar in a vessel above the level of the nest, but communicating with it by a string, the ants, rather than waste time climbing up the string and carrying the sugar down it in infinitesimal loads, placed within the vessel certain of their number who pushed the sugar over the edge, whence it fell to the ground, where it was collected by other ants, who duly conveyed it to the nest.

Lord Avebury, however, conducting experiments to the same end was quite unable to obtain any evidence of similar ingenuity. On the contrary, when the ants could have saved themselves a long and severe climb, and a corresponding descent, by the simple expedient of dropping their treasure for the short distance of three-quarters of an inch, in every case they preferred to carry it over the heavy road.

Mention has already been made of the Slave-making or Amazon Ant. The individuals of this race are particularly fearless, and by reason of the strength of their mandibles, with which they pierce the heads of their enemies, are very formidable. The habit of dependence upon slaves, how-



Photos: 1, 2, and 3, H. Bastin; 4, F. Martin Duncan.

THE BEE AT HOME.

1, A bee nursery, showing grubs of various stages curled in their cells; 2, the grub: three stages of development; 3, the egg and early growth of a bumble bee (much magnified); 4, queen, worker, and drone hive bees; 5, bees at work on a section; 6, a frame hive with the top removed.

ever, has had the inevitable result of debasing the race. To such an extent is this the case that the Amazon is no longer able to feed itself, and when slaves are no longer at hand to provide it with food it starves.

The Warrior Ant, sometimes called the Red Ant, is another slave-making ant, and is not uncommon in some parts of England.

The general appearance of the Hive Bee is so well known as scarcely to need description, for since the earliest times it has been the habit of man to avail himself of the stores of honey which this indefatigable little worker amasses. As in the case of the ant, the Hive Bee exists in three forms, which may be termed Male, Female and Worker, and once again it is upon the worker that the upkeep of the hive primarily depends.

The Queen Bee

The nuptial flight of the queen has more than once formed a theme for the poet, but dealing purely with the more practical side of the question the mating of the queen beyond the limits of her own community may be of considerable importance in securing cross-fertilisation. Even supposing that it is not the invariable rule, it is at least probable that upon occasion the favoured suitor is not a drone of the same hive. Once safely returned, the queen soon enters upon those duties, the fulfilment of which is the sole reason for her existence, and proceeds to deposit her eggs, of which she lays between two and three thousand daily.

In advance of the queen a great host of workers prepare the cells in which the eggs are to be placed. These cells vary somewhat in size according to the use to which they are to be put. Those in which the larvæ of workers are to be reared are, for instance, smaller than those from which the drones are eventually to proceed. A third type of cell, as wide as the drone cell, but somewhat deeper, is prepared for the storage of honey.

It is, then, amongst the types of cell first mentioned that the queen hurries in her passion for the race. Scarcely does she pause even for nourishment. Before and about her crowd attendant workers who furnish her with an abundance of food.

The egg when laid by the queen is elongated and slightly curved and stands upright. With it in the cell the workers deposit a jelly-like mixture compounded of honey and pollen, and thus it remains for the space of three days. On the fourth day the larva makes its appearance and commences to feed upon the jelly. This source of nourishment exhausted, the larva would be in grave danger of starvation were it not for its nurses, who continue to ply it with food until it enters upon the next stage of its career some seven days later.

By this time, it may be noted, the larva has greatly increased in size. The front of the cell which has hitherto been open is now fitted by the workers with a form of lid, of waxlike material, and the larva thus enclosed proceeds to spin a silken cocoon within which it can cast its skin and become a pupa. This stage of its career occupies a full fortnight, but by the close of that time the fully-developed worker emerges from the cell in which but little more than three weeks previous the queen had placed her egg.

But to the bee haste is the essence of life, never in normal circumstances does it know a superfluous day. Even the cell which has just been vacated is not permitted to remain idle. Other workers hurry to the scene to clean it, and later the queen, passing on her rounds with her crowd of attendants, looks in and seeing it prepared, deposits another egg.

Cell Construction

Before noting some of the phases of the life upon which the young worker has just entered, we may well pay a brief tribute to the ingenuity and accuracy of apiarian architecture. Since the days of the earliest observers the bee's cells have exacted admiration, and justly so, for the arrangement which the bee has adopted is precisely the arrangement which, mathematicians tell us, secures for it the greatest number of compartments of proper size within a given area.

We must remember that cells are to be constructed not merely upon one side of the comb, but upon both sides, a fact of considerable importance. Further, other cells are to be made beneath, above and on both sides of it. The form of cell that is most economical of wax, that contains no more space in any part of it than will actually be required, and that permits of other cells being placed without interstices behind, upon both sides, above and beneath it, is an hexagonal cell, and this is precisely the shape the bee has adopted.

The back cells fit exactly into the front cells; each wall is the wall of two cells, each roof is the floor of the cell above, each floor is the roof of the cell below. But what

is possibly more interesting even than the skill displayed in the design of the cells themselves, is the fact that where some impediment interferes with the normal course of construction, the cells are carried round it upon the same space-saving principles. The bee, in short, adapts his general plan of construction to suit the situation, but in every modification of the original plan displays the same mathematical genius.

A. B.

ANATOMY AND PHYSIOLOGY XVI

On the base of the brain can be seen the cranial nerves for the special senses and the face. There are twelve pairs of cranial nerves, as follows :—

(1) *Olfactory*, for the sense of smell. The olfactory nerve rises from the base of the brain just behind the frontal lobe. It runs forward along the under surface of the frontal lobe and ends in a bulb. Numerous nerve-fibres rise from this and pass down through the base of the skull to the mucous membrane lining the nose.

(2) *Optic*, for sight. The optic tracts are seen coming round the crus cerebri on each side, they meet in the middle and appear to cross to the opposite side : in reality only a portion of their fibres cross. They supply the eyes.

(3) *Motor Oculi*. Rises just inside the crus cerebri in front of the pons.

(4) *Patheticus*. Rises from the outer side of the crus.

(5) *Trigeminus*. Comes out of the pons. It consists of two parts (1) motor, for the jaws, (2) sensory, for the face. There are three divisions of this part, one for the forehead, one for the cheek, and one for the lower jaw.

(6) *Abducens*. Rises immediately behind the pons. 3, 4 and 6 supply the muscles which move the eyeball.

(7) *Facial*. Supplies the muscles of the face, and so controls expression. It rises at the lower border of the pons, outside the sixth.

(8) *Auditory*. The nerve of hearing. Supplies the internal parts of the ear within the skull.

(9) *Glossopharyngeal*. Supplies the throat and tongue, and is the nerve of taste.

(10) *The Vagus*. A very large and complex nerve which supplies the throat, the lungs, the heart, and the stomach.

(11) *Spinal accessory*. Supplies one of the muscles of the neck.

(12) *Hypoglossal*. Supplies the tongue.

All the last four rise from the medulla, and all the cranial nerves leave the skull by holes called *foramina* in the base.

Now take another view of the whole brain from the side, separating its various parts as much as possible. The brain-stem can be pulled down from the hemispheres, showing the crura. Below the crura is the pons in front supporting the cerebellum behind. The cerebellum is a compact mass of brain substance which receives fibres both from the brain and from the spinal cord. It has much to do with balance and arranging that when any complicated act, like piano-playing, is performed, the different muscles all work together ; this is called co-ordination.

The elementary facts about the brain are that it consists of a tube, the brain-stem, which is continuous with the spinal cord. This tube has grey matter within, in which are situated the nuclei or collections of nerve cells whence the cranial nerves arise. On the outside of the tube is white matter, which contains the fibres coming from and going to the cerebral hemispheres.

The Spinal Cord

These cerebral hemispheres are outgrowths from the fore part of the tube, and have grey matter on the outside, containing the nerve cells which appreciate the special senses, and sensation from the skin, and those which originate movement.

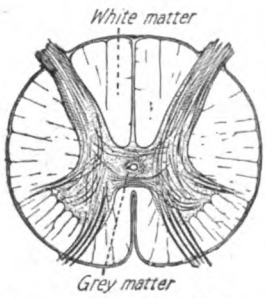
These latter, the motor fibres, pass into the brain-stem as the *pyramidal tract* and pass down the crus, through the pons and medulla and pass to the opposite side.

Sensory fibres, starting from nuclei in the grey matter of the medulla pass upwards, crossing from one side of the brain-stem to the other, enter the crus, and are distributed to the cerebral cortex.

This great trunk of nerve fibres is the continuation of the medulla outside the skull and down the body. The cord is a tube and consists of a central canal, with grey matter round it, and white matter round the grey. It lies in the spinal canal, but does not reach to the end of it, but ends opposite the lower border of the first lumbar vertebra. The upper nerves come off from it at right angles, but the lower ones, which have to reach vertebræ considerably below their point of origin, are much sloped. Below the place where the spinal cord ends, the spinal canal contains the lower lumbar and sacral

nerves running straight downwards. This collection of nerves is called the *cauda equina* or horse's tail. There are two enlargements on the spinal cord, the cervical enlargement where the great nerves supplying the arm enter and leave it, and the lumbar enlargement, where those for the leg are attached.

If you cut the spinal cord across you see that it is nearly circular in section, that there is white matter outside, grey matter inside, and a canal through the grey matter. There is a deep fissure on its back surface, and another on its front surface, not quite so deep.



Section of Spinal Cord.

The grey matter is arranged something like the letter H.

The limbs of the H which point towards the front are swollen and rounded, and are called the anterior horns, they do not reach the edge of the white matter. The limbs which point back are called the posterior horns. They reach up to the edge of the white matter, and mark the point where the posterior nerve roots, that is the sensory or afferent fibres, enter the spinal cord.

Grey and White Matter

The white matter is divided into *tracts*, of which we need only consider two :—

(1) The posterior columns which fill the space between the posterior horn and the posterior fissures ; up these the afferent fibres pass to the nuclei of the medulla ;

(2) The lateral columns, in the angle formed by the anterior and posterior horns, down which pass the fibres from the motor cortex of the brain. These fibres end by entering the anterior horn in each segment and breaking up round the cells there.

The anterior horn cells send out processes, which pass out of the cord and form the anterior roots of the spinal nerves.

The grey matter of the spinal cord is full of nerve cells, which form communications between the afferent cells of the posterior roots and the efferent cells of the anterior horns and roots, and by means of these reflex action takes place.

Reflex action is one of the most important functions of the nervous system, and by it the adaptation to surroundings on which life depends is largely carried out.

A simple reflex which can easily be followed, and will explain the whole of the reflex action is the following :—

Blow sharply into a person's eye. He will blink. By blowing you have irritated the sensitive surface of his eye, which is supplied by the fifth cranial nerve, as a consequence of this the muscles of his eyelid have contracted, and closed his eye. These muscles are supplied by the seventh cranial nerve, and there are paths of communication in the grey matter of the brain between the fifth cranial nerve and the nucleus of the seventh cranial nerve.

Important Reflexes

The reflex is the involuntary contraction of a group of muscles as a consequence of the stimulation (or irritation) of some sensory surface. It is involuntary, that is, it is done without any conscious effort. This, it will be seen, is adaptation to surroundings. The draught of air is painful, and the eye is closed to protect it. The same reflex would be excited if something seriously harmful, like a speck of hot ash, were thrown into the eye.

If either of these nerves were cut, the reflex would be abolished. If the fifth nerve were destroyed, no pain would be felt, and no message carried to the seventh nerve to remove the irritant. If the seventh nerve were destroyed, the pain would be felt, but it would be impossible to close the eye.

For every reflex the sensory nerve, the motor nerve, and the communication between them are all necessary.

The following are some of the important reflexes :—

(1) *Swallowing.* When food is passed into the pharynx it stimulates the nerves of the mucous membrane, and this is followed by contraction of the constrictors of the pharynx, and the food is passed into the œsophagus.

(2) *Micturition.* When urine collects in the bladder from the kidneys it stimulates the nerves of the mucous membrane, the sphincter is relaxed, and the fundus contracts, and expels the urine.

(3) *Coughing.* When a particle of dust is inhaled into the lungs, or when a lump of mucus collects as the result of catarrh, the nerves of the mucous membrane are stimulated. As a consequence of this the larynx is closed, and a violent breathing-out effort is made, the larynx is forced open and the irritating substance driven out.

With regard to micturition, the sensory and motor nerves of the bladder enter and

leave the cord below the last dorsal nerve; there is a centre for micturition quite low down in the cord. But we are not obliged to pass water directly the bladder gets full; we are able to control it for a considerable time, and this control is a function of the higher centres in the cerebral cortex. Sensations pass from the bladder to the cord, and so to the brain; if the bladder were left to itself it would be emptied, but by impulses passing from the brain the sphincter is kept tightly contracted until it is found convenient to release it.

If the cord is damaged in the dorsal region, so that the lower centres are cut off from the brain, no voluntary control is possible, and as soon as the bladder is full it will be emptied whether the person wishes to pass water or not.

Sensory Impulses

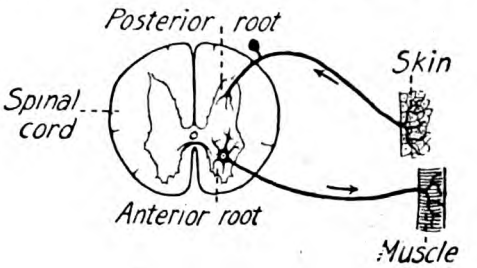
All one's muscular actions, then, depend first on some sensory impulse received by the spinal cord, through a sensory nerve, in consequence of which an impulse is sent down a motor nerve. This is equally true whether we speak of a simple reflex, such as has just been described, or some highly complex voluntary movement made in the course of some technical trade or a game.

When you strike a ball at tennis, deliberately "placing" it in one particular part of the court, you are making co-ordinated movements of many muscles, but you make them in response to the sensory impulse received by your eyes in watching the ball, and communication must exist between your optic nerves and the motor area of your cerebral cortex. Voluntary action, determined by an exercise of the will, is more complicated than reflex action. A good example is that of the sensation of itching on the hand, which causes a conscious effort to scratch it. The sensory stimulus is carried to the spinal cord by an afferent nerve, then to the brain, where we receive the consciousness of the sensation. From the motor area of the brain the impulse is carried back to the spinal cord, thence to the motor nerves of the muscles which impel the action of scratching.

Immediately outside the brain and cord is a thin membrane called the *pia mater*, in which run many blood vessels. Outside is some loose connective tissue filled with lymph, called the *arachnoid membrane*, and outside this and forming a lining to the skull is the *dura mater*, a tough fibrous covering. A fold of dura mater passes down into the longitudinal sinus, and another between the occipital lobes of the brain and the cerebellum, which support and keep in place the parts of the brain.

The cavity of the skull is the space which holds the brain, and is accurately adapted to its shape.

It consists of the domed upper part, the vertex, and the base or under part. If the



REFLEX ACTION,

an example of which occurs in the closure of the eye when anything is brought near it.

vertex is sawn off and one looks down into the base of the skull, one sees on each side three hollows or *fossæ*, one behind the other.

The anterior fossa is shallow, and holds the frontal lobe on each side. Behind this is the middle fossa, which holds the temporo-sphenoidal lobes, and behind this again, the posterior fossa, which holds the cerebellum.

At the bottom of the posterior fossa is the foramen magnum, through which passes the spinal cord.

The base of the skull is perforated by many holes or foramina, through which vessels and nerves pass. The chief of these are :—

(1) In the front and inner part of the anterior fossa, for the olfactory nerves.

(2) At the front and inner part of the middle fossa, for the optic nerve.

(3) Just outside the last, the sphenoidal fissure for the 3rd, 4th, and 6th nerves, and part of the 5th.

(4 and 5) Behind the sphenoidal fissure are the foramen rotundum and the foramen ovale, for the other parts of the 5th nerve.

(6) Just below and behind the ridge separating the middle and posterior fossæ is the internal auditory meatus, through which the auditory nerve enters the internal ear.

(7) At the inner end of this ridge is the opening for the internal carotid artery.

(8) Farther back is a large foramen through which the tributaries of the internal jugular vein and the 9th, 10th, and 11th nerves leave the skull. D. W. C.-J.

Continued from page 162.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A.[Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

LATIN.—XXXVI

WE spoke of the occasional interjection of a sentence or two of direct speech into a piece of oratio obliqua, for the sake of vividness. The verb **inquĭt**, *says he*, is usually employed to introduce the precise words of the speaker, thus—

Negat consilii rem esse Scipio; audendum atque agendum, non consultandum ait in tanto malo esse. Irent secum extemplo armati, qui salutem suam vellent. Pergit ire sequentibus paucis in tabernaculum Metelli, et cum concilium ibi iuvenum de quibus allatum erat invenisset, stricto super capito consultantium gladio, "Ex mei animi sententia," inquit, "ut ego rem propositam non deseram, ita neque alium militem Romanum deserere patiar."

In such extremities it was not deliberation that was required. "Let all," he cried, "who wish to secure their safety put on their arms without delay, and come with me." Followed by a few of them, he went straight to the tent of Metellus, and found there the gathering of young nobles of whom he had heard. Drawing his sword over the heads of the conspirators, he declared it was his fixed resolve not to abandon the expedition, and not to allow any other Roman soldier to abandon it.

It should be noted that **inquĭt** always stands alone; if there be a subject with adjectival adjuncts, or any adverbs to express, they must be placed at the beginning of the sentence, detached, as it were, from the construction, as in the following:—

Tum consul impavidus, qui nullum periculum timeret, summa cum fortitudine, "Nunquam," inquit, "vivus tibi manus dabo."

Then the consul, fearlessly, being daunted by no risk, with the utmost boldness, "Never," said he, "whilst I live, will I give way to you."

The present and the perfect participle are often used predicatively in Latin, and when translated into English may be rendered best by expanding into a relative clause.

Cum sic affectos dimisisset, contione inde advocata ita apud eos locutus fertur.

Dismissing them while they were in this state of mind, he summoned an assembly and addressed them as follows.

Epistolam a Catulo acceptam recitavit.

He read out the letter that he had received from Catullus.

Vixdum profecto occurrit pater.

Hardly had he set out, when his father met him.

Te invito, scribentem eum occupavi.

Against your will, I came upon him while he was writing.

Mihi quis adesset interroganti nihil respondit.

When I asked who was there, he made no reply.

Participles (and also adjectives) are often used independently as substantives, thus—

Insanientis est hoc existimare.

That is the idea of a madman.

Levitatem temere assentientium omitto.

I say nothing of the levity of men who agree without reflection.

The use of the passive participle qualifying the object or subject of a verb and requiring translation into English usually by another active verb has already been illustrated in the exercises. Examples:—

Diadema abiectam rursus sustulit.

He took up the crown again after throwing it away.

Magnus numerus captus interficitur.

A great number were captured and slain.

Some superlatives, such as **prīmŭs**, **summŭs**, **mĕdĭŭs**, **extrēmŭs**, **rĕlīquŭs**, are used, not to express a quality applying to the whole of the object denoted by their substantive, but to define a certain part of the object. Thus **prīmŭs** may be translated, not *the first*, but *the first part of* or *the beginning of;* and **summŭs**, not as *highest*, but as *the top* or *summit of*. Examples:—

Primum ver. *The beginning of spring.*

A primo cogitavit. *He thought so from the beginning.*

In extremo ponte turrim constituit.

He put a tower at the end of the bridge.

In summo monte consedit.

He sat down at the top of the mountain.

Montesque supremos silvifragis vexat flabris.

He lashed the mountain-tops with forest-wrecking blasts.

Summa voce. *At the top of one's voice.*

Some special constructions, which follow, will repay study.

Opŭs est, *there is need of* (lit. *there is work for*), takes the instrumental ablative of the thing needed, thus—

Magistratibus opus est.	*Magistrates are needed.*

Opŭs may also be used as a secondary predicate, thus—

Dux nobis et auctor opus est.	*We have need of a leader and adviser.*

Usŭs est, *there is need of* (lit. *there is use for*), is similarly used, but is rare. Example :—

Curatore usus est.	*There is need for a guardian.*

Dignŭs and **indignŭs** are constructed with the ablative (rarely with the genitive), thus—

Maioribus suis dignissimus.	*Most worthy of his ancestors.*
Dignum salutis.	*Worthy of salvation.*
Indignus honore.	*Unworthy of distinction.*
Indignus magnorum avorum.	*Unworthy of his great forefathers.*

With the ablative are also constructed **contentŭs**, *content*, **frētŭs**, *relying* (on), **laetŭs**, *delighted* (with), **praeditŭs**, *endowed* (with) ; thus—

Pauco contentus.	*Content with little.*
Virtute et viribus fretus.	*Relying on his courage and strength.*
Glande sues laeti redeunt.	*The swine return gladdened with acorns.*

Aptŭs, *fit*, either takes the dative or is followed by **ăd** with the accusative, the same constructions being used with **idōnĕŭs**, *suitable ;* thus—

Castra ad bellum ducendum aptissimum.	*A camp excellently adapted for prolonging the war.*
Non omnibus rebus sunt omnia apta.	*All things are not suitable for all things.*
Idoneus castris locus.	*A good place for a camp.*

Several of these adjectives, especially **dignŭs** and **indignŭs**, **aptŭs** and **idōnĕŭs**, are sometimes constructed with **quī** and a verb in the subjunctive ; examples :—

Hominem idoneum quem ludum facias.	*A suitable man to make game of.*
Indigni qui impetrarent,	*Unworthy to obtain.*

Ūtŏr, **ăbūtŏr**, and some other verbs take an ablative of what would in English be the direct object, thus—

Parvis tegumentis utuntur.	*They use wretched coverings.*
Fungar vice cotis.	*I perform the office of a whetstone.*
Imperio potitus est.	*He has gained possession of the supreme power.*

Order of Words and Clauses

In English the rules of arrangement are rigid. Reverse the order, and you invert the thought. If we mean *Brutus killed Cæsar*, we must use that order of words and no other. But Latin may say **Brutus occidit Cæsarem**, **Cæsarem occidit Brutus**, or **Occidit Brutus Cæsarem**, according to the emphasis it desires to place upon any particular word. There are, in fact, very few words that are in any way confined to or excluded from any particular place in the sentence. Let us review these :—

(A) Words that usually stand first :—

(1) Conjunctions, whether co-ordinate or subordinate.

(2) Relative pronouns (if not governed by prepositions).

(3) Interrogative pronouns (if not governed by prepositions) and adverbs.

(B) Words that may not stand first :—

(1) The enclitics (**-nĕ**, **-vĕ**, **-quĕ**).

(2) Indefinite pronouns and adverbial derivatives of **quīs**, i.e. **quā**, *anywhere*, and **quō**, *to any place*.

(3) The adverbs and conjunctions **vero**, **autem**, **ĕnim**, **igĭtŭr** (usually second, rarely first), and **quŏquĕ**, **quĭdem**, **tămĕn**, which follow the word they emphasise.

The following general principles are derived from the usage of the best authors :—

The emphatic positions in the sentence are the beginning, which calls attention to what follows or marks connection with what precedes, and the end, where the meaning is completed.

From this it follows :—

(*a*) that the sentence should begin with the subject or a word definitely marking transition from what has gone before ;

(*b*) that the sentence should end with a word essential to the completion of the structure or of the sense.

The words that are logically most closely related should be placed in close proximity.

From these principles we may deduce the following chief points to be observed :—

(1) The subject stands first or at the beginning after words marking transition from preceding statements.

(2) The finite verb usually stands last.

(3) Oblique cases of nouns and pronouns, adverbs, and adverbial phrases precede the verbs or adjectives which they qualify.

(4) The direct object is usually placed nearest the verb, that is, after the indirect object.

(5) Adjectives of number and quantity and demonstrative pronouns precede the substantives they qualify.

(6) Adjectives and adjectival phrases, such as an attributive genitive, usually follow the substantive they qualify.

(7) Prepositions precede their cases (except **tĕnŭs**, **versŭs**, and **cum** used enclitically).

(8) In cumulative phrases, consisting of a noun and an adjective or its equivalent, with other complementary words, the usual order is adjective, complements, noun :—

Ingens corporis dolor.
Great bodily pain.
Mira in mediis periculis virtus.
Extraordinary courage in the midst of danger.

These general rules can be abundantly illustrated from any prose work of the classical age ; but the student will do well to mark the deviations from this normal order, and ask himself what is their significance. Thus from the simple statement, **Galli Romam ceperunt**, *the Gauls took Rome*, we may get the following differences of meaning :—

It was the Gauls that took Rome.	Romam ceperunt Galli.
It was Rome that the Gauls took.	Romam Galli ceperunt.
The Gauls actually took Rome.	Ceperunt Galli Romam.

By analogous means, for instance, by placing adjectival or adverbial phrases at the beginning or at the end of a clause, we may give those special prominence and emphasis, as in—

Aeternam nascimur in vitam.	*We are born to life eternal.*
Puerum verberavit crudeliter.	*He beat the boy ruthlessly.*
Capta est Troia causa Helenae.	*It was for the sake of Helen that Troy was captured.*

Examination Questions

What verbs regularly take the ablative case ?

Why do relative pronouns agree with their antecedent in gender and number, but not in case ?

Give the rules for the translation of oratio recta into oratio obliqua, with an example.

What are the main principles governing the order of words and phrases in Latin prose ?

What are the implied meanings of **num**, **-nĕ**, **ăn**, **nonnĕ**, **annōn**, in direct questions ? Give illustrations.

Key to Exercise 34

He said they had sent to the army a youth burning with the lust of sovereign power. They had thus fed the flame with which they were now consumed. Their armies were beleaguering Saguntum, from which they were denied access by treaty ; soon the Roman legions would beleaguer Carthage, under the auspices of the same gods by whom they were avenged in the preceding war. Did they not know the enemy or themselves or the fortunes of either nation ? Their commander had refused ambassadors admission to the camp ; he had infringed international law. Nevertheless, they had come to themselves ; that there might be no public detriment, they demanded the surrender of the culprit. The more lenient they were, the more he feared that, when they made a beginning, they would be more implacably hostile. Let them call to mind the Aegadian Isles, and what they had suffered by land and sea. Their leader then was no youth, but his father Hamilcar himself, a second Mars, as they had desired. . . . The ruins of Saguntum (would that he were a false prophet) would fall on their own heads, and the war begun with the Saguntines would be continued with the Romans. Should they then surrender Hannibal ? some one would ask. He knew that his own authority was in this of small account, but he had rejoiced at the death of Hamilcar because, had he lived, they would then have had war with the Romans ; and he hated and detested this youth as the firebrand and instigator of the present war. He should not only be given up in atonement for the violated treaty, but, if no one demanded his surrender, he should be banished where neither his name nor fame could reach them, nor could he disturb the tranquillity of the State.

(Dixit eos) juvenem flagrantem cupidine regni ad exercitus misisse. Aluisse ergo illud incendium quo tum arderent. Saguntum circumsedere exercitus eorum, unde arcerentur foedere ; mox Carthaginem circumsessuras (esse) Romanas legiones, ducibus eisdem deis, per quos priore bello se sint ulti. Utrum hostem an semet ipsos an fortunam utriusque populi ignorarent ? Legatos imperatorem eorum in castra non admisisse ; jus gentium sustulisse ; illos tamen ad se venisse ; ut publica fraus abesset, auctorem culpae deposcere. Quo lenius agerent, eo, cum coepissent, vereri se, ne perseverantius saevirent. Aegates insulas ante oculos proponerent, quae terra marique passi essent. Nec puerum illum ducem fuisse, sed patrem ipsum Hamilcarem, Martem alterum, ut illi vellent . . . Sagunti ruinas (falsus utinam vates esset) suis ipsorum capitibus incasuras, susceptumque cum Saguntinis bellum habendum cum Romanis esse. Dederentne ergo Hannibalem ? rogaturum esse aliquem. Scire suam levem esse in eo auctoritatem ; sed et Hamilcarem eo periisse laetatum esse, quod, si ille vixisset, bellum jam tum habuissent cum Romanis, atque illum juvenem tanquam furiam facemque ejus belli odisse ac detestari ; nec dedendum solum ad piaculum rupti foederis, sed, si nemo deposceret, abnegandum eo, unde nec ad se nomen famaque ejus accidere neque ille sollicitare quietae civitatis statum posset.

Ceterum nemini omnium major justiorque quam ipsi consuli victoria videri ; gaudio efferri, qua parte copiarum collega victus esset, ea se vicisse : restitutos ac refectos militibus animos, nec quemquam esse praeter suum in imperio collegam qui dilatam dimicationem vellet ; eum, animo magis quam corpore aegrum, memoria vulneris aciem ac tela horrere. Sed non esse cum aegro senescendum. Quid enim ultra differri, aut teri tempus ? quem tertium consulem, quem alium exercitum exspectari ? Castra Gallorum in Italia ac prope in conspectu urbis esse. Non Siciliam ac Sardiniam tum peti, sed solo patrio terraque, in qua geniti essent, pelli Romanos. Quantum ingemiscerent majores sui, si viderent progeniem suam, duos consules consularesque exercitus, in media Italia paventes intra castra, Gallum, quod inter Alpes Apenninumque agri esset, suae potestatis fecisse ! Itaque, nequicquam dissentiente aegro collega, parari ad propinquum certamen milites jubet. E. A. B.

RUSSIAN.—XXVII

The Travellers' Companion

SELECTED PHRASES AND TERMS FOR THE USE OF TRAVELLERS IN RUSSIA

B—HOTELS (*continued from p.* 157)

168. Это включа́етъ та́кже отопле́ніе и освѣще́ніе, ежедне́вныя ва́нны и сти́рку бѣлья́,	*this also includes heating and lighting, daily baths, and laundry.*
169. Согласи́тесь, что я не запра́шиваю,	*you will agree that I am not overcharging.*
170. Хорошо́, ко́нчено, я на э́то согла́сенъ,	*very well, it is settled, I agree to it.*
171. Въ це́нтрѣ го́рода,	*in the centre of the city.*
172. Шу́мный, споко́йный кварта́лъ,	*a noisy, a quiet quarter.*
173. Гдѣ Вы стои́те?	*where are you staying?*
174. Неподале́ку отъ Васъ че́резъ доро́гу (у́лицу),	*not far from you, across the road.*
175. Я стою́ въ меблиро́ванныхъ ко́мнатахъ,	*I stay in furnished rooms.*
176. Удо́бно ли тамъ для Васъ?	*is it convenient for you there?*
177. Я тамъ имѣ́ю всевозмо́жный комфо́ртъ,	*I am quite comfortable there.*
178. А что насчёт прислу́ги?	*and what about the attendance?*
179. Прислу́га ве́жливая и аккура́тная,	*the servants are polite and accurate.*
180. Тамъ о́чень опря́тно,	*it is very clean there.*
181. Затвори́те окно́: хо́лодно,	*close the window; it is cold.*
182. Раздви́ньте за́навѣсъ: свѣтлѣе бу́детъ,	*roll up the curtain; there will be more light.*
183. Закро́йте дверь: сквози́тъ,	*shut the door; it is draughty.*
184. Затопи́те пе́чку: теплѣе бу́детъ,	*light the stove; it will be warmer.*
185. Оста́вьте ключъ въ дверя́хъ,	*leave the key in the door.*
186. Переда́йте ключъ швейца́ру,	*leave the key with the porter.*
187. Швейца́ръ, позво́льте ключъ,	*porter, the key, please.*
188. Есть ли пи́сьма для меня́?	*are there any letters for me?*
189. Почтальо́нъ ещё не прошёлъ,	*the postman has not called (passed) yet.*
190. Имѣ́ю для Васъ телегра́мму,	*I have a telegram for you.*
191. Разбуди́те меня́ ра́но,	*wake me up early.*
192. Пода́йте самова́ръ,	*bring the samovar in.*
193. Звони́ли ли Вы?	*did you ring?*
194. Звоно́къ не дѣйствуетъ,	*the bell is out of order* (does not act).
195. Запаку́йте мои́ ве́щи,	*pack up my things* (luggage).
196. Позови́те извозчика,	*hail* (call) *a cab.*
197. Отпра́вьте мои́ ве́щи на вокза́лъ,	*send off my luggage to the station.*
198. Пода́йте мой счётъ,	*fetch my bill in.*
199. Вотъ Вамъ на чай,	*here is your tip.*
200. Проща́йте!	*good-bye!*

C—FOOD, ETC.

201. Моло́чная,	*dairy.*
202. Что прика́жете?	*what is your order?*
203. Чёрнаго хлѣба съ ма́сломъ,	*black bread with butter.*
204. Пару яи́цъ въ смя́тку,	*two soft boiled eggs.*
205. Я не люблю́ крутыхъ яи́цъ,	*I do not like hard-boiled eggs.*
206. Яи́чницу,	*an omelet.*
207. Кусо́къ твороту,	*a piece of curd.*
208. Таре́лку ки́слаго молока́,	*a plate of sour milk.*
209. Ми́ску смета́ны,	*a tureen of sour cream.*
210. Ча́шку сли́вокъ (кре́му),	*a cup of cream.*
211. Ча́йное заведе́ніе,	*tea-house.*
212. Кофе́йня,	*coffee-house, café.*
213. Конди́торская,	*confectionery.*
214. Стака́нъ ча́ю,	*a glass of tea.*
215. По́рція ча́ю,	*a portion of tea.*
216. Ча́йникъ,	*tea-pot.*
217. Ча́шка чёрнаго ко́фе,	*a cup of black coffee.*
218. Ко́фе со сли́вками,	*coffee with cream.*
219. Лю́бите ли Вы сла́дкій чай?	*do you like the tea sweet?*
220. Неуго́дно ли Вамъ чай съ варе́ньемъ?	*would you like tea with jam?*
221. Я люблю́ шокола́дъ,	*I like chocolate.*
222. Я предпочита́ю како́о,	*I prefer cocoa.*
223. Да́йте па́ру пиро́жныхъ,	*a few cakes, please.*
224. Эти пироги́ съ сы́ромъ,	*this pie is with cheese.*
225. Мнѣ хо́чется марма́ладу,	*I want some marmalade.*
226. Ресторан,	*restaurant.*
227. Вашъ меню́, пожа́луйста,	*your menu, please.*
228. Во́дка,	*Vodka* (Russian brandy).
229. Коньякъ,	*brandy.*
230. Ромъ,	*rum.*
231. Вино́,	*wine.*
232. Шампа́нское,	*champagne.*
233. Пи́во,	*beer.*
234. По́ртеръ,	*porter.*
235. Квасъ,	*kvass.*
236. Лимона́дъ,	*lemonade.*
237. Се́льтерская вода́,	*soda water.*
238. Бу́лка,	*a small loaf.*
239. Бисквитъ,	*biscuit.*
240. Кре́ндель,	*cracknel.*
241. Кала́чъ,	*calatch* (a small loaf).
242. Бара́нка,	*small round cracknel.*
243. Ра́ки,	*crayfish.*
244. Устри́цы,	*oysters.*
245. Ры́ба,	*fish.*
246. Щу́ка,	*pike.*

247. Карпъ, *carp.*
248. Карáсь, *crucian* (a kind of carp).
249. Стерля́дь, *sterlet* (a small sturgeon).
250. Лососи́на, *salmon.*
251. Говя́дина, *beef.*
252. Теля́тина, *veal.*
253. Бара́нина, *mutton.*
254. Свини́на, *pork.*
255. За́яцъ, *hare.*
256. Гусь, *goose.*
257. Цыплёнокъ, *chicken.*
258. Ку́рица, *hen.*
259. Куропа́тка, *partridge.*
260. Го́лубь, *pigeon.*
261. Жарко́е, *roast, roasted.*
262. Котле́та, *cutlet.*
263. Холо́дное, *cold meat.*
264. Колбаса́, *sausage.*
265. Ро́стбифъ, *roast beef.*
266. О́коронъ, *ham.*
267. Ветчина́, *bacon.*
268. Карто́фель, *potatoes.*
269. Мо́рковь, *carrots.*
270. Капу́ста. Щи. Борщь, *cabbage, cabbage soup, beetroot soup.*
271. Горо́хъ, *peas.*
272. Бо́бы, *beans.*
273. Фасо́ли, *French beans.*
274. Крупа́, *groats.*
275. Бураки́, *red-beet soup.*
276. Лапша́, *vermicelli.*
277. Макаро́ны, *macaroni.*
278. Вермише́ль, *vermicelli.*
279. Щаве́ль, *sorrel.*
280. Ка́ша, *gruel.*
281. Супъ, *soup.*
282. Бульо́нъ, *broth.*
283. Гри́бы, *mushrooms.*
284. Кисе́ль, *pudding.*
285 Блини́, *pancakes.*
286. Пу́ддингъ, *pudding.*
287. Пря́ники, *gingerbread.*
288. Моро́женое, *ice cream.*
289. Фру́кты, *fruits.*
290. Оре́хи, *nuts*
291. Желе́, *jelly.*
292. Сала́тъ, *salad.*
293. Соль, *salt.*
294. Пе́ре..., *pepper.*
295. У́ксусъ, *vinegar*
296. Ножъ, *knife.*
297. Ви́лка, *fork.*
298. Ло́жка, *spoon.*
299. Соло́нка, со́лничка, *salt-box, salt-bottle*
300. Салфе́тка, *napkin.*

D—Health and Complaints

301. Какъ Ва́ше здоро́вье? *how are you?*
302. Здоро́вы ли Вы? *are you well?*
303. Какъ себя́ чу́вствуете? *how do you feel?*
304. Спаси́бо, я чу́вствую себя́ о́чень хорошо́, *thanks, I feel very well.*
305. Я совсѣмъ нездоро́въ, *I am not well at all.*
306. Я о́чень бо́ленъ, *I am very ill.*
307. Что тако́е? *what is the trouble?*
308. Я потеря́лъ апети́тъ, *I have lost my appetite.*
309. Я страда́ю безсо́нницей, *I suffer from sleeplessness.*
310. Голова́ моя́ вся кру́жится, *my head is quite going round.*
311. Мнѣ жужжи́тъ въ ушáхъ, *there is a buzzing in my ears.*
312. Но́ги мои́ подка́шиваются, *my legs give way under me.*
313. Позови́те до́ктора, *call a doctor in.*
314. Что Вамъ боли́тъ? *what ails you?*
315. Гдѣ чу́вствуете боль? *where do you feel pains?*
316. Мнѣ боли́тъ голова́, *I have a headache.*
317. Мнѣ боли́тъ въ го́рлѣ, *I have pains in the throat.*
318. Мнѣ ко́летъ въ боку́, *I have a pain in my side.*
319. Име́ю стра́шную зубну́ю боль, *I have an awful toothache.*
320. Меня́ да́витъ и щи́плетъ въ груди́, *I feel pressure and twinges of pain in the chest.*
321. Я е́ле ды́шу, *I can hardly breathe.*
322. У Васъ си́льный на́сморкъ, *you have a severe cold.*
323. Вы простуди́лись, *you have caught a cold.*
324. Вы засо́рили желу́докъ, *your stomach is out of order.*
325. Э́то слѣдствіе си́льнаго напряже́нія, *it is the result of great strain.*
326. Вамъ ну́женъ о́тдыхъ, *you need a rest.*
327. Я Вамъ запишу́ лѣка́рство, *I shall prescribe a medicine for you.*
328. Пошли́те кого́ съ рецептомъ въ апте́ку, *send somebody with this recipe to the (apothecary) chemist's.*
329. Не пуга́йтесь. Всё ско́ро пройдётъ, *do not be alarmed; it will all pass soon.*
330. Че́резъ день и́ли два Вы вполнѣ попра́витесь, *you will quite recover in a day or two.*

E—With the Guide (ПРОВОДНИ́КЪ.)

331. Говори́те, пожа́луйста, о́чень ме́дленно, *please speak very slowly.*
332. Мнѣ тру́дно слѣдовать за ско́рымъ разгово́ромъ, *it is difficult for me to follow rapid conversation.*
333. Покажи́те мнѣ всѣ до́стопримѣча́тельности го́рода, *show me all the noteworthy things in the town.*
334. Что э́то тако́е? *what is this?*
335. Какъ э́то называ́ется по-ру́сски? *what is this called in Russian?*
336. Ра́звѣ Вы уста́ли? *are you tired?*
337. Ся́демъ, отдохнёмъ, *let us sit down and take a rest.*
338. Ско́лько Вамъ лѣтъ? *how old are you?*
339. Вы, полага́ю, жена́ты, *you are a married man, I suppose.*

340. Мно́го ли у Васъ дѣте́й? *have you got many children?*
341. Что дѣлаетъ Вашъ ста́ршій ма́льчикъ? *what is your elder boy doing?*
342. Мно́го ли зараба́тываете? *do you earn much?*
343. Какъ мо́жете жить таки́ми кро́шечными за́работками? *how can you live on such small earnings?*
344. А, понима́ю, э́то то́лько вре́менно, *ah! I see, this is only temporary.*
345. Тепе́рь пойдёмъ, *now we will go.*

F—Amusements

346. Мнѣ о́чень ску́чно, *I feel very weary.*
347. Иди́те въ теа́тръ и́ли о́перу, *go to the theatre or the opera.*
348. Что сего́дня игра́ютъ? *what is being played today?*
349. Но́вую пье́су Берна́рда Шо, *a new piece by Bernard Shaw.*
350. Конце́ртъ, *a concert.*
351. Балъ, *ball.*
352. Маскара́дъ, *masquerade.*
353. Танцова́льный ве́черъ, *dancing evening.*
354. Публи́чное чте́ніе, *public lecture.*
355. Ска́чка, *horse-race.*

G—In the Street

356. Я заблуди́лся, *I have lost my way.*
357. Куда́ хоти́те итти́? *where do you want to go?*
358. Иди́те до того́ угла́, *go up to that corner.*
359. Зате́мъ поверни́те напра́во, *then turn to the right.*
360. Держи́тесь трамва́йной ли́ніи, *keep to the tramway line.*
361. Иди́те всё пря́мо до институ́та, *go along straight up to the Institute.*
362. Тамъ Вы спро́сите городова́го, *there you will ask a policeman.*
363. Господи́нъ городово́й! *officer!*
364. Укажи́те мнѣ путь къ... *tell me the way to . . .*
365. Я не зде́шній, *I am a stranger.*
366. Какъ мнѣ попа́сть на у́лицу....? *how can I get to . . . Street?*
367. Э́то о́чень далеко́ отсю́да, *it is very far from here.*
368. Бери́те трамва́й №.... *take the tramway No. . . .*
369. Куда́ Вы идёте? *where are you going?*
370. Иду́ на прогу́лку, *I am going for a walk.*
371. Пойдёмъ въ городско́й садъ, *let us go (come) to the city garden.*
372. Тамъ игра́етъ но́вый орке́стръ, *a new band plays there.*
373. Лу́чше погуля́емъ по на́бережной, *let us rather have a walk on the quay.*
374. За го́родомъ, *out of town.*
375. Гдѣ нибу́дь въ дере́внѣ, *somewhere in the country (in the village).*

H—Shopping

376. Таба́чная ла́вка, *tobacconist.*
377. Пожа́луйте я́щикъ сига́ръ, *a box of cigars, please.*
378. Мундшту́къ, *cigar or cigarette holder.*
379. Папиро́сница, *cigarette-case (box).*
380. Па́чка папиро́съ, *a packet of cigarettes.*
381. Да́йте папиро́ску, *oblige me with a cigarette.*
382. Фунтъ табаку́, *a pound of tobacco.*
383. Како́й: кре́пкій и́ли сре́дній? *which: strong or medium?*
384. Коро́бка спи́чекъ, *a box of matches.*
385. Да́йте огня́, *give me a light.*
386. Мнѣ ну́женъ га́лстукъ, *I want a tie.*
387. Дю́жина воротнико́въ, *a dozen collars.*
388. Мани́шка, *a front.*
389. Манже́та, *a cuff.*
390. Ве́рхняя руба́шка, *shirt front.*
391. Соло́менная шля́па, *a straw hat.*
392. Поя́рковая шля́па, *a felt hat.*
393. За́понка, *stud.*
394. На́лка, *a stick.*
395. Зо́нтикъ, *an umbrella.*

I—Money

396. Мѣня́льная конто́ра, ла́вка, *money-changing office, shop.*
397. Размѣни́те э́тотъ ба́нкъ-нотъ, *change me this banknote.*
398. Хоти́те ли всё зо́лотомъ и́ли бума́жками? *do you want all in gold or paper?*
399. Мнѣ безразли́чно, *it makes no difference to me.*
400. Да́йте часть серебро́мъ, *give me a part in silver.*
401. Часть ме́лочью, *a part in copper* (small coins).
402. Банки́рская конто́ра, *bankers.*
403. Госуда́рственный Банкъ, *the Imperial Bank (State Bank).*
404. Перево́дъ на Ло́ндонъ, *draft on London.*
405. Че́тверть проце́нта коммиссіи, *one quarter per cent. commission.*

J—Post and Police

406. Почто́во-Телегра́фная Конто́ра, *post and telegraph office.*
407. Почтова́я ма́рка, *post stamp.*
408. Почтова́я ка́рточка, *post card.*
409. Проста́я корреспонде́нція, *ordinary letters.*
410. Заказно́е письмо́, *registered letter*
411. Де́нежное письмо́, *money letter.*
412. Де́нежный (почто́вый) перево́дъ, *postal order.*
413. Квита́нція, *receipt.*
414. Письмо́ до востре́бованія, *letter on call, to be called for* (Poste Restante).
415. Цѣнная посы́лка, *post parcel.*
416. Образе́цъ безъ цѣны́, *samples of no value.*
417. Полице́йское Правле́ніе, *office of the chief constable.*
418. Полице́йскій уча́стокъ, *police station.*

419. Засвидѣтельствованіе по́дписи, *testification, legalisation* (visé of signature).
420. Удостовѣре́ніе ли́чности, *certificate* (testimony) *of identity.*

K—Travelling

421. Путеводи́тель, (railway) *guide.*
422. Вокза́лъ, *station.*
423. Ста́нція, *station.*
424. Нача́льникъ ста́нціи, *station master.*
425. Жандарскій, *gens d'armes* (police).
426. Залъ пе́рваго кла́сса, *first-class waiting-room.*
427. Буфе́тъ, *bar.*
428. Ка́сса откры́та, *the booking-office is open.*
429. Биле́тъ, *ticket.*
430. Пожа́луйте биле́тъ второ́го кла́сса на Москву́, *a second-class ticket for Moscow, please.*
431. Обра́тный биле́тъ, *return ticket.*
432. Круговой биле́тъ, *circular ticket.*
433. Го́денъ на два дня, *valid for two days.*
434. Остерега́йтесь воро́въ! *beware of pickpockets!*
435. Осторо́жно, *with care.*
436. Бага́жная ка́сса, *luggage booking-office.*
437. Бага́жное отдѣле́ніе, *left-luggage office* (store-room).
438. Бага́жная квита́нція, *luggage receipt.*
439. Сдать бага́жъ, *to book the luggage.*
440. Свобо́дный бага́жъ, *free luggage.*
441. Вамъ полага́ется оди́нъ пудъ, *you are entitled to one pood* (36 lb.).
442. Вамъ ну́жно доплати́ть, *you have to pay extra.*
443. Спа́льный вагонъ, *sleeping-carriage.*
444. Пе́рвый звоно́къ, *first bell.*
445. Сѣсть въ вагонъ, *to go into the carriage.*
446. Положи́те чемода́нъ на по́лку, *put the travelling bag* (portmanteau) *on the rack* (shelf).
447. Сакъ-вояжъ, *hand-bag* (carpet-bag).
448. Корзи́на, *hamper.*
449. Сунду́къ, я́щикъ, *case, box.*
450. Узёлъ, *parcel.*
451. Когда́ отхо́дитъ по́ѣздъ? *when does the train start?*
452. Пассажи́рскій по́ѣздъ, *passenger train.*
453. Почто́вый по́ѣздъ, *mail train.*
454. Экстренный по́ѣздъ, *express train.*
455. Това́рный по́ѣздъ, *goods train.*
456. Това́ро-пассажи́рскій по́ѣздъ, *mixed train.*
457. По́ѣздъ идётъ ме́дленно, *the train goes slowly.*
458. По́ѣздъ мчи́тся бы́стро, *the train runs swiftly.*
459. Ста́ршій кондукторъ, *head guard.*
460. Мла́дшій кондукторъ, *guard's assistant.*
461. Контроле́ръ, *checker.*
462. Пять мину́тъ остано́вки, *stoppage for five minutes.*
463. По́ѣздъ стои́тъ полчаса́, *the train stops for half an hour.*
464. Вы имѣете переса́дку, *you will have to change the train.*
465. Вашъ биле́тъ не годи́тся, *your ticket is of no value.*
466. Вы сѣли не въ тотъ по́ѣздъ, *you have got into the wrong train.*
467. Я ошибся въ по́ѣздѣ, *I mistook the train.*
468. Вашъ биле́тъ просро́ченъ, *your ticket has run out.*
469. Что мнѣ дѣлать? *what am I to do?*
470. Куда́ Вы ѣдете? *where are you going to?*
471. Отку́да ѣдете? *where do you come from?*
472. Жела́ю перемѣни́ть биле́тъ, *I want to change my ticket.*
473. Локомоти́въ, *locomotive.*
474. Мостъ, *bridge.*
475. Рѣка́. Кана́лъ, *river, canal.*
476. При́стань, *harbour, port.*
477. Парохо́дъ. Сѣсть на парохо́дъ, *steamer, to go on board.*
478. Каю́та, *cabin.*
479. На па́лубѣ, *on the deck.*
480. Морско́й бе́регъ, *the coast, seashore.*

L—In the Carriage

481. Позво́льте Васъ спроси́ть, *I venture to ask you.*
482. Могу́ ли Васъ попроси́ть? *may I ask you?*
483. Я англійскій по́дданный, *I am an English subject.*
484. Имѣю честь предста́виться, *I beg to introduce myself.*
485. Предста́вить Вамъ моего́ дру́га, *to introduce my friend to you.*
486. Я о́чень радъ познако́миться съ Ва́ми, *I am very pleased to meet you.*
487. Вамъ ещё далеко́ ѣхать? *have you still much farther to go?*
488. Я гдѣ-то Васъ ви́дѣлъ, *I have seen you somewhere.*
489. Да, да, я тепе́рь по́мню, *yes, I remember now.*
490. Какъ Вамъ нра́вится господи́нъ З.? *how do you find Mr. Z.?*
491. Что Вы ду́маете о господи́нѣ Ф.? *what do you think of Mr. F.?*
492. Поѣздка, *excursion.*
493. Я ничего́ не могу́ сказа́ть дурна́го о нёмъ, *I have nothing wrong to say about him.*
494. Вы зна́ете, господи́нъ Т. уме́ръ, *you know, Mr. T. is dead now.*
495. Какъ жа́лко! Онъ былъ сла́вный человѣкъ, *what a pity! he was a nice man.*
496. Интересу́етесь ли Вы литерату́рой? *do you take an interest in literature?*
497. Я раздѣля́ю Ва́ше мнѣніе, *I share your views.*
498. У меня́ ино́й взглядъ на э́то дѣло, *I have a different view* (opinion) *on this matter.*
499. Мы расхо́димся во мнѣніяхъ, *we differ in our opinions.*

500. Но мы согла́сны въ при́нципѣ, *but we agree on the principle* (in principle).
501. Позво́льте Вамъ предложи́ть папиро́ску, *allow me to offer you a cigarette.*
502. Спаси́бо, я не куря́щій, *thanks, I am not a smoker.*
503. Позво́льте огня́, *a light* (fire), *please.*
504. Могу́ ли закури́ть папиро́ску? *may I light* (smoke) *a cigarette?*
505. Я ничего́ не и́мѣю про́тивъ куре́нія, *I do not object to smoking.*
506. Я чу́вствую жа́жду, *I feel thirsty.*
507. Я хочу́ пить, *I want a drink.*
508. Мнѣ хо́чется пить, *I wish to have a drink.*
509. Пойдёмъ къ буфе́ту и напьёмся ча́ю, *let us go to the bar and have some tea.*
510. Я о́чень голо́денъ, *I feel very hungry.*
511. Я хочу́ ѣсть, *I want to eat.*
512. Я бы хотѣлъ что нибудь поку́шать, *I should like to eat something.*

A. C.

GREEK.—XIV

Verbs in -μι

THE older conjugation, containing verbs ending in the first person singular present indicative in -μι, is not very extensive, but contains verbs that are of the commonest use. It is in the present, imperfect, and 2nd aorist, and in the case of a few verbs in the second perfect tenses, that the characteristics appear differentiating it from the other conjugation. The personal terminations are added immediately to the stem or the stem increased by -νυ or -ννυ.

Several verbs in -μι having a monosyllabic stem take in the present and imperfect a reduplication, the initial consonant being prefixed with ι-, as in δίδωμι (stem δο-), *give*, κίχρημι (stem χρᾰ-), *lend*, or if the stem begins with στ or ἑ, an aspirated ἱ being prefixed, as in ἵστημι (stem στᾰ-), *place*, ἵημι (stem ἑ-), *send*.

Verbs in -μι fall into two chief classes:—

(*a*) Such as append the personal endings immediately to the simple or reduplicated stem in the present, comprising all verbs in -ημι and -ωμι, and all that have a 2nd aorist and second perfect and pluperfect of the characteristic forms of the -μι class.

(*b*) Such as insert the syllable -νυ- (-ννυ- after a vowel) between the simple stem and the personal termination, as δείκνῡμι, δείκνῡμεν (stem δεικ-), στρώννῡμι, στρώννῡμεν (stem στρο-). Of this class only the verb σβέννῡμι (stem σβε-), *extinguish*, has the 2nd aorist; the others have the -μι forms only in the present and imperfect.

The following gives all the tenses in use of ἵστημι (stem στᾰ-), *set*, τίθημι (stem θε-), *put*, δίδωμι (stem δο-), *give*, and δείκνῡμι (stem δεικ-), *show*, the forms peculiar to the -μι class being underlined.

The other tenses of these verbs are conjugated on the model of verbs in ω.

Note:—A future perfect active ἑστήξω, *shall stand*, and a middle ἑστήξομαι, *shall have stood*, are formed from the perfect stem of ἵστημι. With this may be compared τεθνήξω and τεθνήξομαι, *shall have died*, from θνήσκω, *die*.

When the perfect of a verb is used in a present sense, the pluperfect has the sense of a single past, e.g. ἕστηκα, *stand*, εἱστήκη, *stood*. The perfect τέθηκα is seldom found.

The full conjugation of the peculiar forms of these verbs is as follows:—

ACTIVE VOICE

	Class I.		*Class II.*	
Present	ἵστημι, *set*	τίθημι, *place*	δίδωμι, *give*	δείκνῡμι, *show*
Imperfect	ἵστην	ἐτίθην	ἐδίδουν	ἐδείκνῡν
Future	στήσω	θήσω	δώσω	δείξω
1st *Aorist*	ἔστησα	ἔθηκα, -ας, -ε	ἔδωκα, -ας, -ε	ἔδειξα
2nd *Aorist*	ἔστην, *stood* (intr.)	ἔθετον, etc.	ἔδοτον, etc.	
1st *Perfect*	ἕστηκα, -ας, -ε, *stand* (intr.)	τέθηκα or τέθεικα	δέδωκα	δέδειχα
2nd *Perfect*	ἕστατον, etc.			
Pluperfect	εἱστήκη or ἑστήκη, *stood* (intr.)	ἐτεθήκη or ἐτεθείκειν	ἐδεδώκη or ἐδεδώκειν	ἐδεδείχη or ἐδεδείχειν

PASSIVE AND MIDDLE VOICES

Present	ἵσταμαι, *stand* (intr.)	τίθεμαι	δίδομαι (pass.)	δείκνῡμαι
Imperfect	ἱστάμην	ἐτιθέμην	ἐδιδόμην (pass.)	ἐδεικνύμην
Future	στήσομαι	θήσομαι	[δώσομαι]	[δείξομαι]
1st *Aorist Middle*	ἐστησάμην, *set for myself* (tr.)	[ἐθηκάμην]		ἐδειξάμην
2nd *Aorist Middle*		ἐθέμην	[ἐδόμην]	
Perfect Passive	ἕστᾰμαι	τέθημαι or τέθειμαι (Middle)	δέδομαι	δέδειγμαι
Pluperfect Passive			ἐδεδόμην	ἐδεδείγμην
Aorist Passive	ἐστάθην	ἐτέθην	ἐδόθην	ἐδείχθην
Future Passive	σταθήσομαι	τεθήσομαι	δοθήσομαι	δειχθήσομαι

Active Voice

ἵστημι (stem στᾰ-), *set*

Present

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	***Participle.***
Sing. 1.	ἵστημι	ἱστῶ	ἱσταίην		ἱστάναι	ἱστᾱς, ἱστᾶσα, ἱστᾰν
2.	ἵστης	ἱστῇς	ἱσταίης	ἵστη		
3.	ἵστησι(ν)	ἱστῇ	ἱσταίη	ἱστάτω		
Dual 2.	ἵστατον	ἱστῆτον	ἱσταῖτον (ἱσταίητον)	ἵστατον		
3.	ἵστατον	ἱστῆτον	ἱσταίτην (ἱσταιήτην)	ἱστάτων		
Plur. 1.	ἵσταμεν	ἱστῶμεν	ἱσταῖμεν (ἱσταίημεν)			
2.	ἵστατε	ἱστῆτε	ἱσταῖτε (ἱσταίητε)	ἵστατε		
3.	ἱστᾶσι(ν)	ἱστῶσι(ν)	ἱσταῖεν (ἱσταίησαν)	ἱστάντων or ἱστάτωσαν		

Imperfect

Sing. 1.	ἵστην
2.	ἵστης
3.	ἵστη
Dual 2.	ἵστατον
3.	ἱστάτην
Plur. 1.	ἵσταμεν
2.	ἵστατε
3.	ἵστασαν

2nd Aorist

Sing. 1.	ἔστην	στῶ	σταίην		στῆναι	στᾱς, στᾶσα, στᾰν
2.	ἔστης	στῇς	σταίης	στῆθι		
3.	ἔστη	στῇ	σταίη	στήτω		
Dual 2.	ἔστητον	στῆτον	σταῖτον (σταίητον)	στῆτον		
3.	ἐστήτην	στῆτον	σταίτην (σταιήτην)	στήτων		
Plur. 1.	ἔστημεν	στῶμεν	σταῖμεν (σταίημεν)			
2.	ἔστητε	στῆτε	σταῖτε (σταίητε)	στῆτε		
3.	ἔστησαν	στῶσι(ν)	σταῖεν (σταίησαν)	στάντων, or στήτωσαν		

τίθημι (stem θε-), *put*

Present

Sing. 1.	τίθημι	τιθῶ	τιθείην		τιθέναι	τιθείς, τιθεῖσα, τιθέν
2.	τίθης	τιθῇς	τιθείης	τίθει		
3.	τίθησι(ν)	τιθῇ	τιθείη	τιθέτω		
Dual 2.	τίθετον	τιθῆτον	τιθεῖτον (τιθείητον)	τίθετον		
3.	τίθετον	τιθῆτον	τιθείτην (τιθειήτην)	τιθέτων		
Plur. 1.	τίθεμεν	τιθῶμεν	τιθεῖμεν (τιθείημεν			
2.	τίθετε	τιθῆτε	τιθεῖτε (τιθείητε)	τίθετε		
3.	τιθέᾱσι(ν)	τιθῶσι(ν)	τιθεῖεν (τιθείησαν)	τιθέντων or τιθέτωσαν		

Imperfect

Sing. 1.	ἐτίθην
2.	ἐτίθεις or ἐτίθης
3.	ἐτίθει or ἐτίθη
Dual 2.	ἐτίθετον
3.	ἐτιθέτην
Plur. 1.	ἐτίθεμεν
2.	ἐτίθετε
3.	ἐτίθεσαν

2nd Aorist

Sing. 1.	[1st Aor., ἔθηκα]	θῶ	θείην		θεῖναι	θείς, θεῖσα, θέν
2.	[,, ἔθηκας]	θῇς	θείης	θές		
3.	[,, ἔθηκε(ν)]	θῇ	θείη	θέτω		
Dual 2.	ἔθετον	θῆτον	θεῖτον (θείητον)	θέτον		
3.	ἐθέτην	θῆτον	θείτην (θειήτην)	θέτων		
Plur. 1.	ἔθεμεν	θῶμεν	θεῖμεν (θείημεν)			
2.	ἔθετε	θῆτε	θεῖτε (θείητε)	θέτε		
3.	ἔθεσαν	θῶσι(ν)	θεῖεν (θείησαν)	θέντων or θέτωσαν		

δίδωμι (stem δο-), *give*

PRESENT

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	δίδωμι	διδῶ	διδοίην		διδόναι	διδούς, διδοῦσα, διδόν
2.	δίδως	διδῷς	διδοίης	δίδου		
3.	δίδωσι(ν)	διδῷ	διδοίη	διδότω		
Dual 2.	δίδοτον	διδῶτον	διδοῖτον (διδοίητον)	δίδοτον		
3.	δίδοτον	διδῶτον	διδοίτην (διδοιήτην)	διδότων		
Plur. 1.	δίδομεν	διδῶμεν	διδοῖμεν (διδοίημεν)			
2.	δίδοτε	διδῶτε	διδοῖτε (διδοίητε)	δίδοτε		
3.	διδόᾱσι(ν)	διδῶσι(ν)	διδοῖεν (διδοίησαν)	διδόντων or διδότωσαν		

IMPERFECT

Sing. 1.	ἐδίδουν
2.	ἐδίδους
3.	ἐδίδου
Dual 2.	ἐδίδοτον
3.	ἐδιδότην
Plur. 1.	ἐδίδομεν
2.	ἐδίδοτε
3.	ἐδίδοσαν

2ND AORIST

Sing. 1.	[1st Aor., ἔδωκα]	δῶ	δοίην		δοῦναι	δούς, δοῦσα, δόν
2.	[„ ἔδωκας]	δῷς	δοίης	δός		
3.	[„ ἔδωκε(ν)]	δῷ	δοίη	δότω		
Dual 2.	ἔδοτον	δῶτον	δοῖτον (δοίητον)	δότον		
3.	ἐδότην	δῶτον	δοίτην (δοιήτην	δότων		
Plur. 1.	ἔδομεν	δῶμεν	δοῖμεν (δοίημεν)			
2.	ἔδοτε	δῶτε	δοῖτε (δοίητε)	δότε		
3.	ἔδοσαν	δῶσι(ν)	δοῖεν (δοίησαν)	δόντων or δότωσαν		

δεικνῡμι (stem δεικ-), *show*

PRESENT

Sing. 1.	δείκνῡμι	δεικνύω	δεικνύοιμι		δεικνῦναι	δεικνύς, δεικνῦσα, δεικνύν; dat. plur. δεικνῦσι(ν), δεικνύσαις, δεικνῦσι(ν)
2.	δείκνῡς	δεικνύῃς	δεικνύοις	δείκνυ		
3.	δείκνῡσι(ν)	δεικνύῃ	δεικνύοι	δεικνύτω		
Dual 2.	δείκνῦτον	δεικνύητον	δεικνύοιτον	δείκνῦτον		
3.	δείκνῦτον	δεικνύητον	δεικνυοίτην	δεικνύτων		
Plur. 1.	δείκνῦμεν	δεικνύωμεν	δεικνύοιμεν			
2.	δείκνῦτε	δεικνύητε	δεικνύοιτε	δείκνῦτε		
3.	δεικνύᾱσι(ν)	δεικνύωσι(ν)	δεικνύοιεν	δεικνύτων or δεικνύτωσαν		

VOCABULARY

ἄν, perhaps, perchance.
ἄπειμι, fut. *ἀπέσομαι, be away from.*
ἄπειμι, shall go from, shall go away.
ἀφᾰνής, -ές, invisible, unknown.
ἀφίημι, send forth, set free, give up.
δεῖ, is necessary.
δέον, τό, what is necessary, duty.
εἴσειμι, shall go in.
ἐφίημι, send to, send for; (mid.) *desire* (with gen.).
ἵνα, in order that.
καθίημι, let down.
μεθίημι, send after, loose.
Νειλος, Nile.
οὔποτε, never.
πατρῷος, -α, -ον, paternal, hereditary.
πέδη, -ης, ἡ, fetter.
πρόσειμι, go to, approach.
στράτευμα, -ατος, τό, expedition, army.

Exercise 14

(*a*) Translate into English :—

1. Ὁ ἀγαθὸς οὔποτε μεθήσει τὰ δέοντα πράσσειν. 2. Πολλοὶ ἀφέντες τὰ φανερὰ διώκουσι τὰ ἀφανῆ. 3. Ξέρξης εἰς τὸν Ἑλλήσποντον πέδας καθῆκεν. 4. Οὐ διὰ τῆς γλώσσης ἀλλὰ δι' ἔργων ἄνθρωπος φίλος ἐμοὶ ἂν γένοιτο. 5. Δίκαιοι ἔστε ἵνα καὶ δικαίων τύχητε.

(*b*) Translate into Greek :—

1. Do not pursue the unknown giving up that which is known. 2. Many men desire wealth. 3. Xerxes is said to have let down fetters into the Hellespont. 4. The Nile empties itself into the sea by seven mouths. 5. Whatever shall come after is the concern of the gods.

Key to Exercise 13

(*a*) 1. The expedition sailed away. 2. The expedition will sail away to-morrow. 3. All the winds blew against the expedition. 4. The soldiers expected that they would run to the doors. 5. The enemy will throw the ranks of the soldiers into confusion. 6. The city has been burnt down by the enemy.

(*b*) 1. Ὁ ἄνεμος ἐναντίος τῇ στρατίᾳ ἔπνευσεν. 2. Ἐν τῇ ναυμαχίᾳ τῇ ἐν κόλπῳ Κρισαίῳ οἱ Πελοποννήσιοι ἄνδρας τῶν Ἀθηναίων ἀπέκτειναν, ὅσοι μὴ ἐξένευσαν αὐτῶν. 3. Ὅταν οἱ πολεμίοι τῇ πόλει πλησιάσωσιν, οἱ στρατιῶται ἀναρπάσαντες τὰ ὅπλα θεύσονται πρὸς τὰς πύλας. 4. Τίς οὐκ ἂν κλαύσειε τὸν φίλον ἀτυχῆ; 5. Συγκέχυκε νῦν τὴν πίστιν ὁ καθ ἡμᾶς βίος. 6. Οἱ πολεμίοι τὰς τῶν Ἀθηναίων τάξεις συνέχεαν.

E. A. B.

SPANISH.—XVI

Numeral Adjectives.—*Distributives :* **La mitad,** *the half ;* **el tercero** or **la tercera parte,** *one third ;* **el cuarto** or **la cuarta parte,** *one quarter ;* **el octavo** or **la octava parte,** *one eighth ;* **el décimo** or **la décima parte,** *one tenth ;* **la undécima parte,** *one eleventh ;* **la duodécima parte,** *one twelfth.* After one tenth, fractions are usually formed from cardinal numbers with **-avo,** as **un dieciseisavo,** *one sixteenth ;* plural, **tres dieciseisavos ;** etc.

Though many write **avos** as a separate word, the more regular way is to elide the last letter of the cardinal number, if a vowel, and add **avo, avos,** as **tres cienavos,** *three hundredths,* or **tres centésimos ; un onzavo,** *one eleventh,* or **un once avo,** changing **ce** into **z,** to preserve the correct pronunciation.

Collectives.— **Un par,** *a pair;* **una decena,** *half a score, about ten,* the ending **ena** meaning "approximately" the preceding number ; **una veintena,** *a score ;* **una treintena,** *about thirty ;* etc., **una centena, un ciento,** *a hundred ;* **un millar,** *about a thousand.*

Un is not placed before **ciento** and **mil,** except to avoid ambiguity, as **tres cientos un mil fardos,** 301,000 *bales,* because **trescientos mil fardos** would mean 300,000 *bales.*

Degrees of Comparison.—Adjectives are compared by placing **más** or **menos** before and **que** after them. If in the superlative, the definite article precedes **más** or **menos.**

Comparative degree : **Yo tendría más que V.,** *I should have more than you.*

Note that the pronoun is necessary when the verb might refer to either a first or third person singular, which is always the case in the Imperfect and Conditional Indicative and all tenses of the Subjunctive.

(*Relative*) *Superlative degree :* **Don Juan es el más rico de los socios,** *Mr. John is the richest of the partners.*

(*Absolute*) *Superlative degree :* **Don Juan es riquísimo** or **muy rico,** *Mr. John is very* (or *most*) *rich.*

Examples

La mayor parte de estos libros están llenos de faltas.	*The most* (greater part) *of these books are full of mistakes.*
Los más días trabajo.	*Most days I work.*
Lo más que yo pueda hacer es esto.	*This is the most I can do.*
Es lo menos que V. pueda ofrecerme.	*It is the least you can offer me.*
El mayor y el menor de los hermanos.	*The elder and the younger of the brothers.*

(Note the special use of these adjectives when not referring to size.)

Esta carta tiene tantas faltas cuantas (or como) la otra tenía.	*This letter has as many mistakes as the other one had.*

Tanto . . . cuanto (or como), *as much . . . as,* is a comparison of equality.

Tengo más de siete libras, pero V. no tiene más que seis.	*I have more than £7, but you have not more than six.*

Note.—**De** = *than,* instead of **que,** before a numeral, but in a negative sentence **que** must be used before a numeral. (In practice this rule is often infringed upon.)

Esta caja no es tan grande como aquella.	*This case is not as big as that one.*
Son tan inteligentes como ricos.	*They are as intelligent as rich.*
Esta calidad es superior á lo que parece.	*This quality is better than it looks.*

(SUPERIOR takes **á** after it as complement.)

Somos ahora más felices de lo que éramos hace dos años	*We are happier now than we were two years ago.*

Irregular Comparatives.—The following list should be carefully read.

Positive		*Comparative*	*Relative Superlative*	*Abstract Superlative*
good	bueno	mejor, *better*	el, la mejor, *the best*	óptimo, *very good.*
great, large	grande	mayor, más grande	el, la mayor, el más grande	máximo, *very great, large.*
little, small	pequeño	menor, más pequeño	el, la menor, el más pequeño	mínimo, *very little, small.*
low	bajo	inferior, más bajo	el, la inferior, el más bajo	ínfimo, *very low, base.*
high	alto	superior	el, la superior, el más alto	supremo, *very high, supreme.*
bad	malo	peor	el, la peor	pésimo, *very bad.*
a little, few	poco, pocos	menos, *less, fewer*	los, las menos, *the least, fewest*	poquísimo, *very little, very few* (pl.).
much, many	mucho, muchos	más	los, las más, *the most*	muchísimo, *very much, very many* (pl.).

Note.—" Than " is rendered by **de lo que** when followed by a verb; but when a substantive comes between **más** or **menos**, " than " is translated by **del que, de los que, de la que, de las que,** as :—

La casa exporta más bultos de los que exportaba el año pasado.	*The firm exports more packages than it exported last year.*
La carta de V. contiene menos faltas de las que esperaba encontrar	*Your letter contains less faults than I expected to find.*
Los negociantes más honrados en la ciudad.	*The most honourable merchants in the city.*

Note that the article is not repeated in the relative superlative when the adjective follows its noun.

VOCABULARY

el pago adelantado, *payment in advance.*
salir á, *to come out at* (a price, etc.).
la edad, *age.*
la falta, *fault, lack, mistake.*
señalar, *to point out, mention.*
la aduana, *custom house.*
el chelín, *shilling.*
devolver, *to return* (a thing).
conozco (conocer), *I know* (a person, etc.).
desgraciadamente, por desgracia, *unfortunately.*
parecer, *to look, appear.*
el crédito, *credit.*
la libra esterlina, *pound sterling.*

Exercise 29

Translate into English :—

1. La mitad del pedido no se ejecutará. 2. Queremos pago adelantado por la tercera parte de la factura. 3. El artículo no deberá salir á más que (or de) cinco y tres dieciseisavos la yarda. 4. Hemos comprado una treintena de cajas de esta misma calidad. 5. No sé cuantos años él tiene, pero serán unos treinta hasta treinta y dos. 6. Estamos hoy á veinte y dos de abril de mil novecientos veinte. 7. ¡ Díganme Vs. cuántos años tienen ! 8. ¿ Qué edad tiene (¿ Cuántos años tiene ? ¿ Cuál es la edad de ?) su socio de V. ? 9. Hoy día no hay absolutamente ningunos negocios con Petrogrado. 10. No hemos visto nunca dibujos más bonitos que estos. 11. Los tejidos que hemos recibido son peores que los del año pasado. 12. Los más días él pasa á no hacer nada. 13. La mayor parte de estas telas crudas está llena de faltas. 14. También son inferiores á la muestra. 15. La factura llamada rectificada contiene tantas faltas cuantas (or como) la original tenía. 16. No se debe exceder la cantidad máxima señalada. 17. Eso es menos de lo que yo pensaba.

Exercise 30

Translate into Spanish :—

1. I do not yet know whether I can execute the half or only one-third of your order. 2. The quality I want must not come out at more than two shillings and threepence per metre. 3. They have had to return twenty of the worst pieces to the manufacturer. 4. How old are you ? 5. I am thirty-five years of age to-day, which is my birthday. 6. Nowadays the prices are so high that it is almost impossible to live. 7. I have never seen dearer goods than these. 8. John is the youngest of the three brothers, but he is the biggest. 9. He is the tallest boy (that) I know. 10. The most we can do is one thousand pieces. 11. There are less than (about) a hundred pieces in each bale. 12. It is unfortunately the most we can offer them. 13. The elder and the younger of the brothers are partners in the same firm. 14. We have less than fifty-five cases in that steamer and not more than five hundred in this. 15. Our qualities are better than (what) they look.

Key to Exercise 23

1. I know very well that for various reasons they have broken for ever with that firm. 2. Know that in the remittance of to-day we have included all that we owed you. 3. Be persuaded that we shall be able to explain everything to your entire satisfaction. 4. The bills enclosed in our letter by the last post are the firsts of exchange ; the second ones corresponding we have enclosed yesterday in the letter which we sent you through the intermediation of our traveller. 5. Having read the whole letter, we went to see the manufacturer. 6. Having said this, the client presented me with patterns of all that he had bought before. 7. Having arrived exactly at the hour, we had the pleasure of seeing the representative of the firm before his departure. 8. The preparations made, we sent a telegram to our agent. 9. Knowing that there is yellow fever in that port and that our representative is very ill, we shall be uneasy until definite news arrives. 10. Having been warned of the danger, our friend did not wish any longer to prolong the matter, and therefore he paid the amount due.

Key to Exercise 24

1. Estos pupitres no cabrán en nuestro escritorio (despacho). 2. Leída (*or* Despues de leída) esta explicación, él querrá ver los géneros mismos. 3. Que venga, pronto le convenceré que tenemos razón. 4. Lo sabrán mañana y entonces harán lo necessario en el asunto. 5. Valdrá la pena de ver la cara de él cuando sepa que hemos descubierto la bribonada que nos ha hecho. 6. Chanzas aparte, haré todo lo que pueda cuando yo venga á verle á V. la semana que viene. 7. Tantas personas no cabrían fácilmente en esta casa. 8. Falto completamente de recursos, visité entonces á todos mis parientes y amigos, pero ellos no podían prestarme ningún dinero. 9. Le pondría á V. ciertamente un telegrama si yo necesitase (necesitara) el dinero antes de entonces. 10. Vaya V. al Señor González y explíquele que si no recibimos su remesa antes del fin del mes, pondremos el asunto en manos de nuestro abogado. 11. Protestada la letra, fuimos á consultar con un abogado sobre los mejores medios de conseguir el pago. 12. No dé V. largas á este negocio, pues estamos con cuidado y queremos concluir el contrato.

Key to Exercise 25

1. Obedient to the laws, these merchants have had much prosperity during recent years. 2. He gave me his hand, and said to me : " You have done very well, and now sleep in peace ! " 3. The customer conducted me to the house of his friend, of whom I asked for explanations of all that had been done. 4. I put forth all my efforts to execute the order satisfactorily. 5. We shall put in the bill of lading the two cases of patterns. 6. Send me a telegram as soon as you arrive at your destination. 7. I put it before him that I did not wish to support him in such an action. 8. We went to see various clients from whom we obtained large orders. 9. We satisfied (paid) you by return of post, and we do not know why you ask us for the said amount again. 10. On hearing this, you knew all, and it is useless now to pretend ignorance.

A. C.

Continued from page 166.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

THE BRITISH ISLES.—II

THE physical features of Ireland are on the whole less pronounced than those of Great Britain. Though plain is the characteristic, yet in about half the counties there are hills or mountains rising above 2,000 feet in altitude.

The most important of the groups of highlands are in Donegal where the rugged hills may be looked upon as a prolongation of the northern Scottish uplands; in County Down where the southern Scottish uplands are prolonged into the Mourne Mountains, and in Wicklow where the hills correspond to the Welsh hills. By the lower Shannon and on the Atlantic seaboard of Connaught and Munster are more or less parallel ridges stretching out in a seaward direction.

The great midland plain of Ireland is composed of Carboniferous limestone covered in many parts with glacial debris. This formation is almost horizontal, the coal bearing rocks having been washed away except for very insignificant remains now found in Leinster.

Rivers and—

The principal watershed of England coincides as to its northern extremity with the Pennine Chain, running from the Cheviot Hills to the peak in Derbyshire. Thence it may be considered as bending south-west round Cheshire into the Welsh mountains. This watershed separates the easterly flowing rivers such as the Tyne, Wear, Tees, the Yorkshire streams flowing into the Ouse, and the Trent, from the westerly flowing streams such as the Severn, flowing into the Bristol Channel, the Lune, Ribble, Mersey and Dee which empty themselves into the Irish Sea.

Another watershed extends practically along the escarpment of the Oolite. This forms the southern boundary of the Midland basin, the chief rivers of which are the Warwickshire Avon, which receives the Severn at Tewkesbury (although the combined rivers below this point are known by the name of the latter), and the Trent flowing into the Humber.

The Jurassic escarpment forms another and parallel divide separating the rivers flowing into the Wash, such as the Nen and the Welland from the easterly flowing rivers like the Yare and the Stour. The Thames, however, whose headwaters are on the south-east of the Oolite escarpment, cuts through this secondary Jurassic escarpment (represented by the Chiltern Hills) between Wallingford and Reading.

—Watersheds

Another important watershed is that separating the Thames valley from the rivers flowing into the English Channel. It takes a line from Wiltshire to Kent and throws off the Wey and Medway to join the Thames, and the Stour to the Strait of Dover, and the Wiltshire Avon, Itchen, Arun and Sussex Ouse to the English Channel. The divide takes the line of the Wealden uplift and the streams thrown off have had to cut their way through the higher ground of the North and South Downs with the result that "gaps" have been formed such as those at Guildford, Maidstone, Arundel, Lewes, etc.

In Scotland the system of drainage is more complex than in the southerly portion of Great Britain. The reason for this appears to be that the rivers were formed when the present ancient rocks were covered with newer formations, now washed away and disappeared. As a consequence of this we find the rivers cutting through ranges of hills which would have been expected to form divides and generally following courses not easily explicable from the present contours of the land.

As an example we may take the case of the river Tay, which exhibits several changes of course along longitudinal valleys and transversely across hill ranges. This river rises

Photo: Taunt & Co.

WHERE THE THAMES RISES.

Trewsbury Mead in the Cotswolds. The Thames owes its importance not to its size or its volume but to the situation of its mouth opposite to the continent of Europe, and the excellent harbour it affords.

Photo: Photochrome Co., Ltd.

THE PRECIPICE WALK, DOLGELLY.

For sheer wealth of colour and beauty of grouping few places in Britain can vie with the grandeur of the mountain districts of Wales.

in Ben Lui on the extreme west of Perthshire on the borders of Argyll and runs along a valley as far as Tyndrum, where it turns south-east transversely to the lie of the country to Crianlarich. There it enters a long north-easterly valley, from which it takes the name of the Dochart, through Loch Tay when, below Pitlochry, it again takes a transverse course and flows into the Vale of Strathmore. It now takes a south-westerly direction along this valley for a short distance until, at Perth, it again cuts a transverse course through the Sidlaw range and finally emerges into the Firth of Tay in a north-easterly direction along another longitudinal valley.

In Ireland the drainage system is more or less regular, though in the case of the Shannon, which has cut a gorge in a group of isolated hills near Killaloe, we have another example of the fact that the course of the river was probably determined long before the existing surface of the land was exposed, and that it originally flowed over rocks laid down more recently than those over which it now takes its course. The Shannon is the longest river in the British Isles and is 225 miles long.

Rivers Shannon and Thames

Some of the Irish rivers, and of these the Shannon is a notable example, exhibit a tendency to expand into lakes throughout some portions of their course. As far as Killaloe nearly half the length of the Shannon is through the three lakes of Loughs Allen, Ree and Derg. Most of these lakes have been formed, like the Great Lakes of North America, by the solution of the Carboniferous limestone in the waters of the rivers.

The most important river in the British Isles is undoubtedly the Thames. Compared with other rivers of the globe, its length of some 200 miles is insignificant; it owes its importance, not to its size or volume, but to the fact that situated as it is opposite to the continent of Europe and affording a good harbour for ships of large draught, it has encouraged the growth of the capital of the British Empire upon its banks.

At London Bridge the Thames is about 260 yards wide and from here to the sea it expands into an estuary which at its mouth at the Nore is some five miles wide. Vessels of large size can ascend the river as far as Blackwall, and small river steamers as far as Oxford. Beyond this barges ascend to Lechlade, where is the junction of the Thames and Severn canal. Not without reason do Londoners apostrophise their river as " Father Thames."

Like the Thames, the other important rivers of Great Britain owe their importance to the fact that at or near their mouths are situated nearly all the great ports of the country. The Humber, an estuary formed by the junction of the Trent and the Ouse, has the ports of Grimsby and Hull on its banks. The Tees and the Tyne estuaries are the outlets of Middlesbrough and Newcastle with North and South Shields and Tynemouth. On the Firth of Forth is Leith, the port of Edinburgh, and the great naval base of Rosyth. The Clyde is the avenue to Glasgow and the Mersey to Liverpool.

The Swift-flowing Severn

The Severn is of about the same length as the Thames, but owing to its swiftness and shallowness through a great part of its length is not commercially so useful. Its estuary gives admittance through the Avon to the port of Bristol; and at Sharpness a canal allows vessels of 16 feet draught to ascend as far as Gloucester. The lower reaches of this river are noted for the " bore " or tidal wave which ascends as far as Gloucester with a crest sometimes several feet in height. The Severn rises in Wales on the slopes of Plynlimmon, and takes a course almost semicircular in form flowing past the interesting historical towns of Shrewsbury, Bridgnorth, Worcester, Tewkesbury and Gloucester. Shortly after passing the latter city it widens out to form its estuary and flows into the Bristol Channel.

The lakes of Great Britain are found practically exclusively in the upland regions, being particularly numerous in Scotland. In England there are many, though of small size, in Westmorland, Cumberland, and Lancashire; in North Wales they are also numerous, though the largest, Lake Bala, is but four miles long. The Scottish lakes are of much larger size, Loch Ness, the longest, being 23 miles long and filling a narrow trough of great depth, and Loch Lomond, the largest in area (27 square miles), with a length of 21 miles.

Round the various lakes is situated some of the most beautiful scenery in the British Isles. Occasionally, as in the case of Thirlmere in Cumberland, the lake has been utilised as a water supply for a great city; in this case of Manchester.

In Ireland the lakes are of larger size, the largest being Lough Neagh, 153 square miles in area. The total area of the Irish lakes is nearly 1,000 square miles, actually

almost three per cent. of the total area of the island.

The chief minerals found in the British Isles are coal and iron, and they are largely found in conjunction with one another. Of these coal is perhaps the more important. The chief coal-fields are found in the lowland district of Scotland, in South Wales and Monmouth, in Yorkshire, Derby and Nottingham, in Northumberland and Durham, in South Lancashire and in Staffordshire. Smaller coal-fields occur in Warwickshire, Cumberland, North Wales and Somersetshire, near Bristol also in the Forest of Dean in Gloucestershire and some in Ireland.

Coal and Iron

The production of coal in Great Britain is not only sufficient for the needs of the country but is an important article of export; the South Wales coalfield exporting by far the greatest amount.

Iron is found largely distributed, often near to the coal-fields. The richest iron ore is that known as Hæmatite which occurs in Cumberland. The largest quantities of iron ore are, however, now obtained from the Cleveland district of Yorkshire and in the Barrow district of Lancashire with the adjoining regions of Cumberland.

The limestone used in combination with coal in the smelting of the iron is also found usually in the same districts as these other minerals, often occurring in the Carboniferous series, though in some cases, for instance in the South Staffordshire district, a limestone of Silurian age is largely used.

Of other metals, tin found in Devon and Cornwall has been mined from prehistoric times. Indeed the islands were known to the ancients as the Cassiterides or Tin Islands, and the metal is still worked in the same districts as it has been for numberless generations. Zinc is found in small quantities in Wales, the Isle of Man and in Cumberland. Copper was formerly mined in Devon and Cornwall, though it is now nearly worked out. A small quantity of gold is found in Wales and in various other parts. Lead and silver are worked to a small extent in the north of England and in Scotland in the Leadhills. Of other minerals of less importance there are found arsenic, manganese, wolfram, besides building stones of various kinds; china-clay (in Cornwall), fire-clay and oil which is both extracted from shales and obtained by boring.

The vegetation of the British Isles is that of the north temperate regions. The forests which once covered the country have now practically disappeared, though remains amounting to only four per cent. of the area are found in various districts such as the Forest of Dean, the New Forest, Epping Forest, Needwood Forest, etc. The highlands of the country are mostly covered with grass and are of the nature of moorland or bog. Cereals are chiefly grown in the southern and eastern portions of England, root crops all over the country where the soil is rich enough. In Ireland the great midland plain is chiefly given over to grazing and pasture forms about 80 per cent. of the cultivated land. Potatoes are grown on about half a million acres and this is the chief root crop.

Fauna of Britain

The fauna of Great Britain is of the palæarctic type. But the species are less numerous than on the continent of Europe owing to the separation of the islands from the mainland during the Glacial period. Bears, wolves and the wild boar have become extinct within comparatively recent times, the only large wild animals now existing being the red and fallow deer.

The common domestic animals are cattle, sheep, horses and pigs, the latter being especially numerous in Ireland. Horses thrive best in the Yorkshire district and in the basin of the Wash; they are also reared largely in the north of Ireland. The freshwater fish of Great Britain are of little importance except for sport, though an exception may perhaps be made of the salmon of the Scottish and Irish rivers. The sea fisheries of the North Sea are, however, of great commercial importance, and cod, plaice, soles, turbot, etc., are largely caught on the Dogger Bank. Herrings are caught all round the coast, and off the Cornish peninsula pilchard fishing employs many of the seafaring population.

The fisheries of the United Kingdom are responsible for some twenty-one million pounds' worth of fish being landed in the country annually. Grimsby, Hull, and Aberdeen are the most important markets. Yarmouth and Lowestoft are noted centres for the east coast catches, and, indeed, around the coasts of these islands the fishery is always at least of local importance.

Roughly speaking, about fourteen million of the population are engaged in industrial and commercial pursuits; two and a half million in domestic occupations; over two and a quarter million in agriculture and one million in the various professions. C. J. S.

Continued from page 173.

MATHEMATICS:

Contributor: — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.

(M. A. Lewenz, M.A.[Lond.]).

HYDROSTATICS.—I

1. MATTER exists in three forms. We have **solids, liquids**, and **gases**. In the course on Mechanics we dealt with solids; in the present course we shall deal with **fluids** (i.e. liquids and gases). The most striking difference between a solid and a fluid is that the former has a definite shape, while the latter has not. If we consider any solid such as a piece of iron, or a piece of clay, we realise that such a piece of matter has a definite shape. By applying very considerable force we may change the shape of the iron, by exerting less force we may change that of the clay; we may even drive a stick through the latter. But in any case an appreciable amount of force will have to be exerted, and when the force is removed, the *body will retain its new shape*, unless subjected to a further exertion of force.

Now consider a fluid such as water or air; water will immediately take the shape of any vessel into which it is poured; also, although we may experience considerable difficulty in cutting through a solid, we shall find it easy to pass a knife-blade through water, and moreover while in the former case the body remains cut in two, in the latter no permanent impression is left by the knife, and the water, after a few moments, will present the same appearance as before the knife-blade passed through it. Now, if we consider air, we find that the resistance offered to bodies passing through it is even less than in the case of water. If you wave your hand, you cleave the air with it, but you feel no resistance.

From the above considerations we conclude that solids tend to retain their shape, and that the particles of which they are composed do not move freely among themselves, whereas a fluid changes its shape in response to the exertion of the slightest force, and the particles of which it is composed move freely among themselves, or in other words slide over one another.

2. Liquids and gases.—If we fill a vessel full of water, we cannot compress the water so as to make the vessel hold more; on the other hand, if we pour some water out of a vessel, the vessel will remain partly empty. But we can compress a very large amount of air into a vessel, and if from a closed vessel, full of air, we remove part of the air, what remains will immediately expand so as to fill the whole vessel.

Thus a **liquid** is a fluid which has a definite volume and offers great resistance to pressure[1] (i.e. cannot be compressed to any appreciable extent), whereas a **gas** is a fluid which has no definite volume, but which can be compressed into a very small volume by the exertion of force, and which tends to expand so as to occupy as large a volume as possible, if no force be exerted on it.

3. Many substances exist under ordinary conditions in all three states. Thus we have ice (solid), water (liquid) and steam (gas). By exerting very great pressure, and lowering the temperature, gases can be converted into fluids. The requisite temperature and pressure vary greatly with different gases.

4. Fluids differ greatly with regard to the mobility of their particles. In a perfect fluid, the particles are supposed to slide over one another without any friction. No such perfect fluid really exists, but gases approach more nearly to this ideal state than liquids. In some liquids, such as treacle and tar, the friction among the particles is sufficient to affect the mobility of the substance quite appreciably. Such liquids are termed **viscous.**

5. Newton's Laws of motion apply equally to all branches of dynamics, but the mobility of fluids causes them to behave differently from solids. This branch of **Mechanics** dealing with fluids is termed **Hydrodynamics,** and we are concerned with two subdivisions of it, namely **Hydrostatics** which deals with liquids at rest, and **Pneumatics** which deals with gases. All fluids will be treated as if they were perfect fluids[1] to simplify the investigation. For the systems of units used, the student is referred to the course on Mechanics.

6. From the point of view of Mechanics, the essential difference between a solid and a fluid lies in the manner in which the two transmit pressure. Suppose we have a piston which exactly fits a tube; if we exert pressure on one end of the piston it will be transmitted without any diminution to the other end; there will be no pressure exerted on the sides of the tube. But if we fill the tube with water and exert pressure at one end, this pressure will be felt not only at the other end of the tube, but also on the sides, and, moreover, this pressure everywhere equals that exerted at the one end. This is usually expressed by saying that: *fluids transmit pressure equally in all directions.*

[1] A *perfect liquid* has been defined as an incompressible perfect fluid.

7. Pressure of Fluids in General at Rest.—*The pressure of a fluid at rest is always perpendicular to every surface on which it acts.*

If this were not the case the pressure could be resolved into two components, one **normal** to the surface and one **along** it; this latter would be able to produce motion, and consequently the fluid would not be at rest.

Intensity of pressure is measured by the amount of pressure exerted on unit area. Thus if the total pressure on an area a be P, then p, the pressure on unit area, is given by $p = \frac{P}{a}$.

Pressure is said to be uniform when the amount of pressure exerted on equal areas is equal.

The total pressure on any plane area exposed to uniform fluid pressure is the product of the total area and the pressure on unit area, i.e. $P = p \times a$.

When any pressure is applied to any part of a fluid it is transmitted equally and uniformly throughout the fluid.

This is known as **Pascal's Principle** and may be illustrated experimentally in the following way:

We take a vessel having various openings fitted with water-tight pistons. This we fill with water. Suppose the openings to be all of the same size,

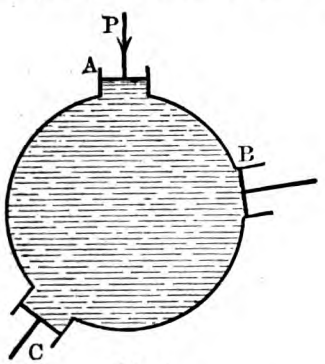


Fig. 1.

and the pistons to have just sufficient pressure on them to keep them in equilibrium.

If now an additional pressure P be applied at A, it will be found that an equal pressure must be applied at B and C to keep the pistons in equilibrium.

Next suppose the openings are of different sizes and consequently of different area; let the area at A be a sq. in., that at B, b sq. in., and that at C, c sq. in.

Then the intensity of pressure at $A = \frac{P}{a}$,

i.e. $\frac{P}{a} = p$.

We shall find that the pressures P' and P'' required at B and C to keep the pistons in equilibrium are respectively given by $P' = \frac{bP}{a}$ and $P'' = \frac{cP}{a}$,

i.e. $P' = bp$ and $P'' = cp$, or $p = \frac{P}{a} = \frac{P'}{b} = \frac{P''}{c}$.

This shows that the intensity of pressure throughout the fluid is the same.

These experiments illustrate Pascal's Principle.[1]

8. The Bramah Press or Hydraulic Press.—This press is based on the foregoing principle. It consists in essence of a large cylinder A and a small cylinder B connected by a pipe in which is water. There are two pistons, C and D, which can slide up and down. On top of C is a flat board

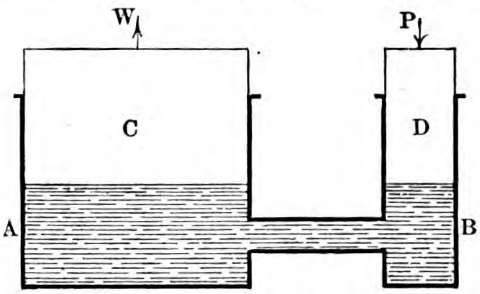


Fig. 2.—Illustrating the principle of the Bramah Press.

or tray on which the substance to be pressed is placed, and above this is a fixed frame. When D is very small and C very large, a small downward pressure P on D will produce a very large upward pressure W on C since the intensity of pressure throughout the water is the same. The substance consequently gets pressed between the tray and the frame. Thus, if the area of D be 1 sq. in. and the area of C be 100 sq. in., a pressure P of 1 lb. on D will produce an upward pressure of 100 lb. on C.

Mechanical advantage of the Bramah Press

If C and D be the areas of the large and small pistons, P the downward pressure on the small piston, W the resistance to be overcome at C, due to the weight of the substance to be pressed:

Then, since the pressure due to P, uniformly distributed over the area D, is equal to that due to the force W, distributed over the area C,

$$\frac{P}{D} = \frac{W}{C}$$

$$\therefore \text{ Mechanical advantage} = \frac{W}{P} = \frac{C}{D}.$$

The pistons are in practice circular, hence if c and d be their diameters,

$$C = \tfrac{1}{4}\pi c^2 \text{ and } D = \tfrac{1}{4}\pi d^2$$

$$\therefore \frac{W}{P} = \frac{\frac{1}{4}\pi c^2}{\frac{1}{4}\pi d^2} = \frac{c^2}{d^2}.$$

9. The Hydrostatic Paradox.—This name is applied to the fact that, in consequence of Pascal's principle, a quantity of water, however small, may be made to support a weight, however large.

10. The Safety Valve.—This is attached to boilers and hydraulic presses, so that the pressure of the fluid should not become so great as to burst the boiler or press.

It consists essentially of a pipe A connected with the fluid. This pipe is closed by the valve V, which

[1] The weight of the water has been neglected; we shall deal with this point later.

is held down by a weight W which slides along the bar C D, which is hinged at C. By moving W along the bar the pressure at which V will be raised and the fluid consequently escape may be regulated.

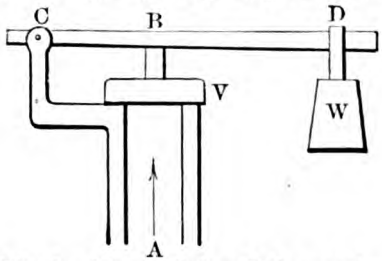


Fig. 3.—How a Safety Valve works.

11. We must now take into account the weight of fluids.

The weight of a fluid acts not only on the surface but throughout the substance, and therefore varies at different areas.

The **average pressure** of a fluid over any plane area is the total pressure on that area, divided by the area.

The **pressure at a point** of a fluid is the average pressure taken over an indefinitely small plane area in which the given point lies.

In a heavy liquid at rest the pressure is the same at all points in the same horizontal plane.

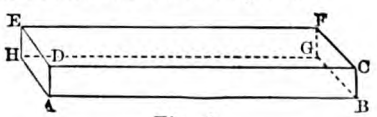


Fig. 4.

Consider a small rectangular portion of the liquid having the edges A B, C D, E F, G H horizontal.

The portion is at rest, ∴ the forces acting on it are in equilibrium.

These forces may be taken as the weight W of the liquid acting vertically, and pressures acting on the vertical faces acting perpendicular to them.

Let the pressure on A D E H = P, and that on B C F G = Q. P and Q act parallel to A B, and all the other forces are perpendicular to P and Q. Therefore since there is equilibrium P × area of A D E H = Q × area of B C F G.

Now these areas are equal, ∴ the average pressures on A D E H and B C F G are equal.

If we take these faces infinitesimally small, then the pressure at A = pressure at B, which two points are in the same horizontal plane.

12. *The pressure in a uniform heavy liquid varies with the depth.*

Consider a thin rectangular column of the liquid.

Let the area of the horizontal planes be a and b, and let b be at a depth z below the surface.

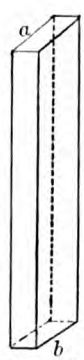


Fig. 5.

Then b will have a downward pressure on it equal to the weight of the column of liquid above it, all other forces acting perpendicularly to this.

Let s equal the weight of unit volume of the liquid, then the weight of the column $= z\ b\ s$.

If p = pressure at any point in b

then $p \times b = z \times b \times s$, or $p = z \times s$.

If b is not horizontal, the pressure will vary at different points of b, but by taking b infinitesimally small we may regard the area as a point and hence we get $p = z \times s$ as before.[1]

The increase of pressure corresponding to an increase of depth in a heavy fluid may be found as follows :—

Let P be the pressure at a point A, and P_2 the pressure at a point B vertically below A. Let this distance from A to B = h, and s = weight of unit volume of the liquid.

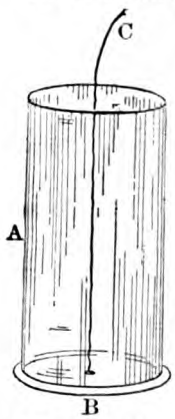


Fig. 6.—To show experimentally that $P_2 = P_1 + sh$.

Then the pressure at B = pressure at A + weight of the column of liquid between B and A.

i.e. $P_2 = P_1 + sh$ or $P_2 - P_1 = sh$.

The above may be experimentally verified.

Take a small cylindrical vessel A, open at both ends and having a movable base B which can be held up by a string C. If we attach C to one end of a balance, and keep B pressed against the open end of A by attaching a weight W to the other end of the balance, and then pour water into A, we find that when the water has risen to a certain height, B will fall off.

If we double the weight W, the height to which the water will rise before B falls off will be double the height in the former case.

This shows that the pressure on B due to its depth below the surface of the water varies with the depth.

Exercise 1

(1) The small piston (or pump-plunger) of a Bramah Press is ½ inch in diameter, and the large one 8 inches ; the pump-plunger is worked by a handle 4 feet long, the fulcrum being 1 inch from the point of attachment of the plunger (see diagram of safety valve). What is the greatest weight that can be lifted by hanging a weight of 12 stone on the end of the handle ?

(2) A closed cubical vessel measuring 4 feet each way is filled with fluid ; a piston 3 inches in area is inserted in one side and pressed inwards with a force of 10 lb. Find the increase of pressure on the six sides.

(3) A safety valve of area ½ sq. in. is held down by a weight of 20 lb. attached to the longer arm of a lever whose arms are 2 in. and 1 ft. What pressure will be required to lift the valve ?

---

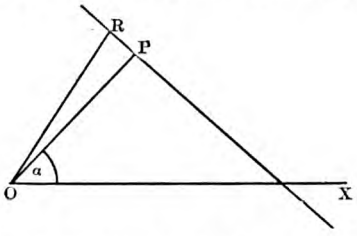
[1] We have taken the pressure on the surface at a to be zero, but atmospheric pressure or any other pressure may have to be taken into account.

M. A. L.

CO-ORDINATE GEOMETRY.—IV

The Straight Line (*continued*)

32. *To find the polar equation of a straight line.*



Let O X be the fixed axis, O P the perpendicular p from the origin on the given line.

Let R be any point on the line and angle X O P = α.

Then O R = r and X O R = φ

$\therefore$ P O R = $\varphi - \alpha$.

Now, O R cos P O R = OP,

Hence the required equation is $r \cos(\varphi - \alpha) = p$ (i)

If we take O P as the fixed axis, the equation becomes $r \cos \varphi = p$ (ii)

Equation (i) may also be obtained by writing $r\cos\varphi$ for x and $r \sin \varphi$ for y in the equation $x \cos \alpha + y \sin \alpha = p$.

33. *To find the polar equation of a line through two fixed points.*

If P and Q be the two points and their co-ordinates r', φ' and r'', φ'' respectively,

Let R be any other point on the line with co-ordinates r, φ.

Then $\triangle$ P O Q + $\triangle$ Q O R − $\triangle$ P O R = 0,

hence $r'\, r'' \sin(\varphi'' - \varphi') + r''\, r \sin(\varphi - \varphi'') - r\, r' \sin(\varphi - \varphi') = 0$ and the required equation is

$r'\, r'' \sin(\varphi'' - \varphi') + r''\, r \sin(\varphi - \varphi'') + r\, r' \sin(\varphi' - \varphi) = 0$.

34. *A homogeneous equation of the nth degree in x and y denotes n straight lines passing through the origin.*

Let the equation be

$A_0 x^n + A_1 x^{n-1} y + A_2 x^{n-2} y^2 + \ldots\ldots\ldots + A_{n-1} x y^{n-1} + A_n y^n = 0$.

Dividing by y^n we get

$$A_0 \frac{x^n}{y^n} + A_1 \frac{x^{n-1}}{y^{n-1}} + A_2 \frac{x^{n-2}}{y^{n-2}} + \ldots\ldots\ldots + A_{n-1} \frac{x}{y} + A_n = 0.$$

Let $\alpha, \beta, \gamma \ldots\ldots$ be the n roots of this equation, then it may be resolved into the factors

$$\left(\frac{x}{y} - \alpha\right)\left(\frac{x}{y} - \beta\right)\left(\frac{x}{y} - \gamma\right)\ldots\ldots = 0.$$

This is satisfied if $\frac{x}{y} - \alpha = 0$, if $\frac{x}{y} - \beta = 0$, if $\frac{x}{y} - \gamma = 0$, etc., and in these cases only.

Therefore all points on the locus represented by the original equation lie on one or other of the n straight lines

$x = \alpha y$, $x = \beta y$, $x = \gamma y$ . . ., etc.

35. Consider the equation $Ax^2 + Bxy + Cy^2 = 0$.

This represents the two straight lines $x - \alpha y = 0$ and $x - \beta y = 0$, where α and β are the roots of the equation $\frac{x^2}{y^2} + \frac{Bx}{Ay} + \frac{C}{A} = 0$.

Hence $\alpha + \beta = -\frac{B}{A}$ (i) and $\alpha\,\beta = \frac{C}{A}$.

If φ be the angle between the two lines,

$$\tan\varphi = \frac{\alpha - \beta}{1 + a\beta} = \frac{\sqrt{(B^2 - 4AC)}}{A + C}$$

Therefore, if $B^2 - 4AC$ is positive, the lines are real.

If $B^2 - 4AC = 0$, the lines are coincident.

If $B^2 - 4AC$ is negative, the lines are imaginary.

36. Consider the general equation of the second degree, $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ (i).

Let us find the condition that this may represent two straight lines.

Solving (i) as a quadratic in x and y, we have, provided a is not zero,

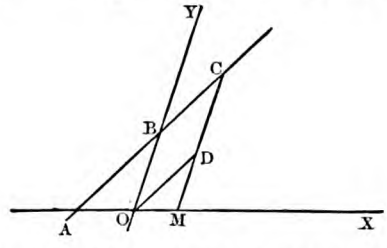
$ax + hy + g = \pm\sqrt{\{(h^2 - ab)\, y^2 + 2(hg - af)\, y + g^2 - ac\}}$.

In order that this may be reducible to the form $Ax + By + C = 0$, the quantity under the radical sign must be a perfect square,

i.e. $(h^2 - ab)(g^2 - ac)$ must $= (hg - af)^2$

or $abc - af^2 - bg^2 - ch^2 + 2fgh = 0$.

37. Oblique Axes.—Hitherto we have only dealt with the equations of lines referred to rectangular axes. We now will deal with a line referred to oblique axes.



To find the equation of a straight line referred to axes inclined at an angle ω.

Let A B C be a straight line cutting the axes in A and B.

Let x y be the co-ordinates of the point C on the line.

Draw C M parallel to the axis of Y and O, D parallel to A B C.

Then M C = M D + D C (i)

Now, $\frac{\text{M D}}{\text{O M}} = \frac{\sin \text{M O D}}{\sin(\omega - \text{M O D})}$

= some constant, say m.

Also D C = O B = a constant, say c.

Hence (i) may be written $y = mx + c$, which is the required equation. Many of the theorems in the preceding paragraphs apply equally well to oblique axes.

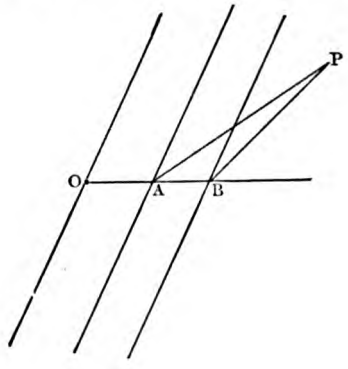
38. Examples:

(1) Through a fixed point O any straight line is drawn cutting two parallel straight lines in A and B. From A and B straight lines are drawn in fixed directions meeting in P.

Show that the locus of P is a straight line,

Take O as the origin.

Through O draw a line parallel to the given parallel straight lines and take this as the axis of y.



Let the equations of the given parallel straight lines be $x = a$, $x = b$.

If the equation of the line O A B be $y = mx$, since the abscissa of A is a, therefore the ordinate of A is ma. Similarly the ordinate of B is mb.

Since A P, B P are always drawn in fixed directions, let A P be parallel to $y = m'x$ and B P parallel to $y = m''x$.

Then the equation of A P will be

$y - ma = m'(x - a)$ (i),

and the equation of B P will be

$y - mb = m''(x - b)$ (ii).

Now, the co-ordinates of P satisfy both (i) and (ii), hence from (i) and (ii) we can find the co-ordinates of P for any particular value of m.

But we want to find an expression for the co-ordinates of P which is independent of m, hence we eliminate m from (i) and (ii) and we get

$y(b - a) = m'b(x - a) - m''a(x - b)$

Now, this is an equation of the first degree, hence the locus of P is a straight line.

(2) Given the base and the difference of the squares on the sides of a triangle, to show that the locus of the vertex is a straight line.

Take the base A B as the axis of x, and the straight line perpendicular to A B through its middle point O as the axis of y.

Let A O = K and let the co-ordinates of the vertex C be x, y.

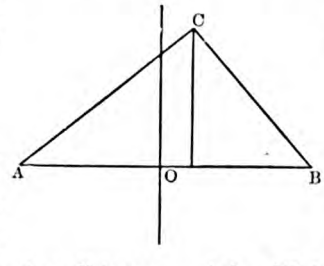
$AC^2 = y^2 + (K + x)^2$,

$BC^2 = y^2 + (K - x)^2$

$\therefore AC^2 - BC^2 = 4Kx$

Now, $AC^2 - BC^2$ is a given constant l.

Hence the equation of the locus of C is $4Kx = l$.



This is the equation of a straight line perpendicular to the base A B at a distance $\frac{l}{4K}$ from the middle point.

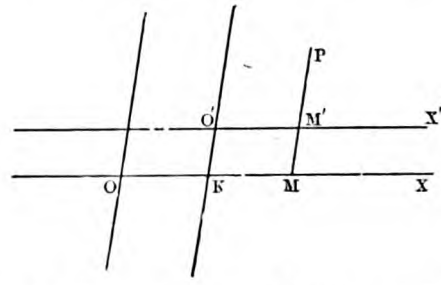
Change of Axes.

39. *To change the origin of co-ordinates without changing the direction of the axes.*

Let O X, O Y be the original axes; O′ X′, O′ Y′ the new axes where O′ X′ is parallel to O X, and O′ Y′ to O Y.

Let h and k be the co-ordinates of O′ referred to the original axes.

Let P be any point whose co-ordinates referred to



the original axes are x, y, and whose co-ordinates referred to the new axes are x', y'.

Draw P M parallel to the axis of Y cutting O′ X′ at M′ and O X at M.

Then $x = OM = OK + KM = OK + O'M' = h + x'$

and $y = MP = MM' + M'P = KO' + M'P = k + y$.

If these values of x and y in terms of the new co-ordinates be substituted in the equation of any curve, we have the equation of that curve referred to the new axes.

40. *To change the direction of the axes without changing the origin.*

Let O X, O Y be the original axes and O X′, O Y′ the new axes.

Let angle X O X′ be φ.

Let P be any point whose co-ordinates referred to the old axes are x, y and referred to the new axes x', y'. Draw P M perpendicular to O X and P M′ perpendicular to O X′. Draw M′ K and M′ L perpendicular to P M and O X respectively.

$x = OM = OL - ML = OL - KM' = OM' \cos\varphi - M'P \sin\varphi = x' \cos\varphi - y' \sin\varphi$.

$y = MP = MK + KP = LM' + KP = OM' \sin\varphi + M'P \cos\varphi = x' \sin\varphi + y' \cos\varphi$.

Here as in the last § the old co-ordinates are expressed in terms of the new, and hence we can express the equation of any curve with reference to the new axes.

41. Examples:

(1) What does the equation $x^2 + y^2 - 4x + 2y = 0$ become when the origin is changed to the point $(-2, 3)$?

We change the origin by putting $x = x' - 2$ and $y = y' + 3$. The equation then becomes

$(x' - 2)^2 + (y' + 3)^2 - 4(x' - 2) + 2(y' + 3) = 0$,

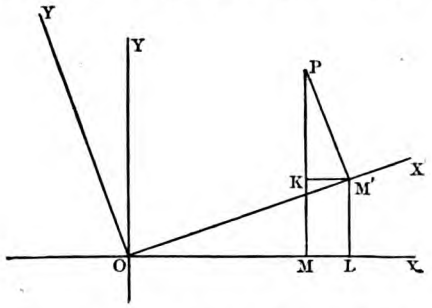
or $x'^2 + y'^2 - 8(x' - y') + 27 = 0$,

or, suppressing the accents,

$x^2 + y^2 - 8(x - y) + 27 = 0$.

(2) What does the equation $x^2 + 4xy + 2y^2 - 3 = 0$ become when referred to rectangular

axes through the point $(2_1 - 1)$, the new axis of x making an angle of 60° with the old ?



Change the origin by putting $x = x' + 2$, $y = y' - 1$, the equation becomes

$(x' + 2)^2 + 4(x' + 2)(y' - 1) + 2(y' - 1)^2 - 3 = 0$,

or, suppressing the accents,

$x^2 + 4xy + 2y^2 + 4y - 5 = 0$ (i)

To turn the axes through 60°, we must put

$$x = x' \cos 60° - y' \sin 60° = \frac{x'}{2} - \frac{\sqrt{3}y}{2}$$

and $y = x' \sin 60° + y' \cos 60° = \frac{\sqrt{3}x'}{2} + \frac{y'}{2}$.

Equation (i) then becomes

$$\left(\frac{x'}{2} - \frac{\sqrt{3}y}{2}\right)^2 + 4\left(\frac{x'}{2} - \frac{\sqrt{3}y}{2}\right)\left(\frac{\sqrt{3}x'}{2} + \frac{y'}{2}\right) + 2\left(\frac{\sqrt{3}x'}{2} + \frac{y'}{2}\right)^2 + 4\left(\frac{\sqrt{3}x'}{2} + \frac{y'}{2}\right) - 5 = 0,$$

or, suppressing accents,

$$\frac{7 + 4\sqrt{3}}{4}x^2 - \frac{4 - \sqrt{3}}{2}xy + \frac{5 - 4\sqrt{3}}{4}y^2 + 2\sqrt{3}x + 2y - 5 = 0.$$

The Circle

42. *To find the equation of a circle referred to any rectangular axes.*

Let C be the centre of the circle and P any point on the circumference.

Let the co-ordinates of C be a, β and those of P x, y.

Let r be the radius of the circle.

Draw C M, P N parallel to the axis of Y, and C L parallel to the axis of X, cutting P N in L.

$r^2 = CP^2 = CL^2 + LP^2 = MN^2 + LP^2 = (ON - OM)^2 + (NP - NL)^2 = (ON - OM)^2 + (NP - MC)^2 = (x - a)^2 + (y - b)^2$.

Hence $(x - d)^2 + (y - \beta)^2 = r^2$ (i) is the required equation.

Now this equation can be written

$x^2 + y^2 - 2\alpha x - 2\beta y + d^2 + \beta^2 - r^2 = 0$.

Hence the equation of a circle is of the form $x^2 + y^2 + 2gx + 2fy + c = 0$ (ii)

where g, f and c are constants.

Referring to the general equation of the second degree,

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$,

we see that this is the equation of a circle if $a = b$ and $h = o$.

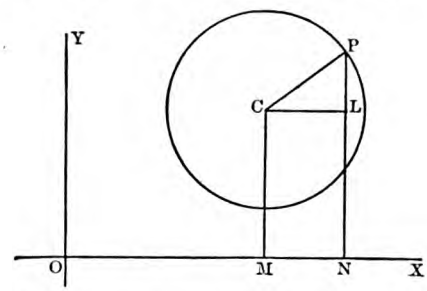
Any such equation of the second degree, fulfilling these conditions, may be expressed in the form $(x - a)^2 + (y - b)^2 = r^2$, for we may write it thus: $x^2 + y^2 + \frac{2g}{a}x + \frac{2fy}{a} + \frac{c}{a} = 0$,

or $\left(x + \frac{g}{a}\right)^2 + \left(y + \frac{f}{a}\right)^2 = \frac{1}{a^2}\{g^2 + f^2 - c^2\}$ (iii).

Hence any point on the locus is at a constant distance from the point $\left(\frac{-g}{a}, \frac{-f}{a}\right)$, and that distance $= \frac{\sqrt{g^2 + f^2 - c^2}}{a}$. Hence (iii) represents a circle of radius $\frac{\sqrt{g^2 + f^2 - c^2}}{a}$ with centre $\left(\frac{-g}{a}, \frac{-f}{a}\right)$.

If $\sqrt{g^2 + f^2 - c^2} = 0$, the radius of the circle is zero.

If $\sqrt{g^2 + f^2 - c^2}$ is negative, no real values of



x and y will satisfy the equation and the circle is imaginary.

We may take two special cases which are of frequent occurrence.

Referring to (i), we see that if the origin is at the centre of the circle, $\alpha = 0$ and $\beta = 0$, hence (i) becomes $x^2 + y^2 = r^2$.

If the axis of X be a diameter and the axis of Y be a perpendicular at one extremity, then $\alpha = r$ and $\beta = 0$, and the equation becomes $x^2 + y^2 = 2rx$.

43. Consider the general equation of a circle

$x^2 + y^2 + 2gx + 2fg + c = 0$.

This contains three constants ; hence if we require the equation of a circle passing through three fixed points, we assume the above form of the equation and determine the constants g, f and c accordingly.

Exercise 7

(1) What does the equation $x^2 + 3xy - 2y^2 + 6x + 8y - 10 = 0$ become when the origin is transferred to the point (— 2 1) ?

(2) Transform the equation $x^2 - y^2 + 2x + 4y = 0$ to axes through the point (— 1, 0) parallel to the lines bisecting the angles between the original axes.

(3) Find the equation of the circle which passes through the points (0, 1), (1, 0), (2, 1).

(4) Find the radius and the co-ordinates of the centre of the circle $4x^2 + y^2 + 4x - 2y + 1 = 0$.

(5) Show that if the co-ordinates of the extremities of a diameter of a circle be (x', y') and (x'', y'') respectively, the equation of the circle will be $(x - x')(x - x'') + (y - y')(y - y'') = 0$.

Key to Exercise 4

(1) $x^2 + y^2 = n^2 - m^2$. (2) $3x^2 - y^2 = 0$.

Key to Exercise 5

(1) 3, 5. (2) 2, — 6. (3) 4, — 2. (4) the line passes through the origin. (8) $\frac{x}{5} + \frac{y}{5} = 1$.

Key to Exercise 6

(1) $\frac{3}{5}x + \frac{4}{5}y - 3 = 0$. (2) $7x - y + 2 = 0$, $3x + y + 3 = 0$, $3y - x + 4 = 0$; $(-\frac{1}{2}, -\frac{3}{2})$. (3) 4. (4) on opposite sides. (5) 45°. (6) $88y - 66x - 101 = 0$. (7) $4x + y - 9 = 0$. (8) $7x - 9y + 34 = 0$, $9x + 7y - 12 = 0$. M. A. L.

MENSURATION.—II

Mensuration of the Circle

13. *To find the circumference of a circle.*

Suppose we have a circle of radius r and that a regular polygon of n sides is inscribed in the circle, while another regular polygon of n sides is described about the circle. Let the centre of the circle be O and the inscribed polygon be A B C . . . . . and the circumscribed polygon be $a\ b\ c$ . . . . . .

The perimeter of the circumscribed polygon $= 2nr \tan \frac{\pi}{n}$

The perimeter of the inscribed polygon $= 2nr \sin \frac{\pi}{n}$

Hence $\frac{\text{perimeter of circumscribed polygon}}{\text{perimeter of inscribed polygon}} = \frac{1}{\cos \frac{\pi}{n}}$

Now clearly the perimeter of the circle itself lies between the perimeters of the inscribed and circumscribed polygons.

As the number of the sides of the polygons is indefinitely increased, i.e. as n approaches infinity, $\frac{\pi}{n}$ approaches the value 0, and therefore $\cos \frac{\pi}{n}$ approaches the value 1.

Hence when n becomes infinitely great, the ratio of the two perimeters is as 1 : 1

That is to say, in the limit, when n becomes infinitely great, the perimeters become equal. But since the perimeter of the circle lies between the perimeters of the two polygons, the perimeter of the circle must equal that value to which the perimeters of the polygons both approach, when n becomes infinitely great.

We may therefore define the perimeter of a circle as that value to which the perimeter of the inscribed (or of the circumscribed) regular polygon of n sides approaches, when n becomes infinitely great.

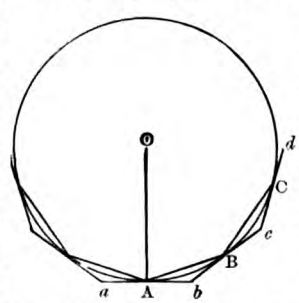


Fig. 14.—To find the circumference of a circle.

14. Suppose there are two circles with centres O and o and radii R and r.

Let A B C D . . . . .

and $a\ b\ c\ d$ . . . . .

be regular polygons of n sides inscribed in these circles, and let P and p be their perimeters.

Join O B, O C and $o\ b$, $o\ c$.

Since $\triangle$s O B C, $o\ b\ c$ are similar

$\therefore$ O B : $o\ b$ = B C : $b\ c$ = $n \times$ B C : $n \times b\ c$

$\therefore$ R : r = P : p

i.e. $\frac{P}{R} = \frac{p}{r}$

Now let the circumference of the circle of radius

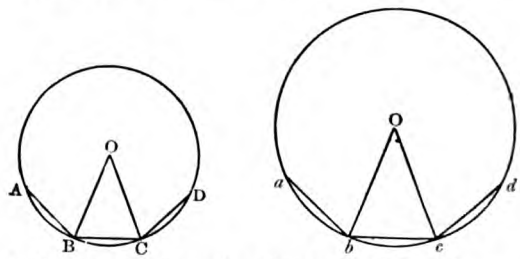


Fig. 15.—To show that the ratio of the circumference of a circle to its diameter is constant.

R = K and the circumference of the circle of radius $r = k$.

Then if n be made infinitely great, in the limit P = K and $p = k$.

Hence we have $\frac{K}{R} = \frac{k}{r}$ and $\therefore \frac{K}{2R} = \frac{k}{2r}$

i.e. **the ratio of the circumference of a circle to its diameter is constant.**

This constant is denoted by π, an incommensurable number equal to 3·14159 . . . . .

Thus we have $\frac{K}{2R} = \pi$ or $\mathbf{K = 2\pi R}$

15. *To find the area of a circle.*

Consider the figure in § 13.

The area of the circumscribed polygon $= nr^2 \tan \frac{\pi}{n}$

the area of the inscribed polygon $= nr^2 \sin \frac{\pi}{n} \cdot \cos \frac{\pi}{n}$

$\therefore \frac{\text{area of circumscribed polygon}}{\text{area of inscribed polygon}} = \frac{1}{\cos^2 \frac{\pi}{n}}$

When n becomes infinitely great this ratio = 1 (since $\cos 0^\circ = 1$).

And since the area of the circle lies between the areas of the polygons, we may, by a similar process of reasoning to that in § 13, arrive at the definition that: **the area of a circle is that value to which the area of the inscribed (or circumscribed) polygon of n sides approaches, when n becomes infinitely great.**

Now the area of the circumscribed polygon

$= \frac{1}{2} r \times n \times ab$ (where r = radius of circle)

$= \frac{1}{2} r \times$ perimeter of polygon.

But when n becomes infinitely great perimeter of polygon = perimeter of circle

$\therefore$ **area of circle**

$= \frac{1}{2} r \times$ perimeter of circle

$= \frac{1}{2} r \times 2\pi r$

$= \pi r^2$

16. *To find the area of an annulus or circular ring.*

Let R and r be the radii of the circles A C D, B E F forming the inner and outer circumferences of the annulus.

Area of annulus

$= \text{area of } \bigcirc \text{ B E F} - \text{area of } \bigcirc \text{ A C D}$

$= \pi R^2 - \pi r^2$

$= \pi (R^2 - r^2)$

$= 2\pi \times \frac{(R + r)(R - r)}{2}$

$= 2\pi \times \frac{R + r}{2} (R - r)$

$=$ **2 π × mean radius of annulus × its breadth.**

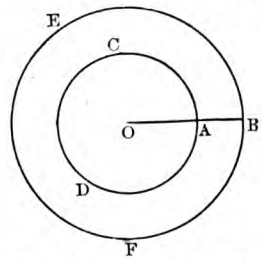


Fig. 16.—To find the area of an annulus.

17. *To find the area of a sector of a circle.*

Let O A P be a sector of a circle of centre O and radius r.

Divide the arc A P into a number of equal arcs A B, B C, C D. . . .

When the number of these arcs is indefinitely increased, each of them becomes indefinitely small and the chord of each arc may be considered equal to the arc itself.

The area O A P will equal the rectilineal area O A B C D E . . . . . P

But this latter is the sum of the triangles O A B, O B C, O C D . . . . . .

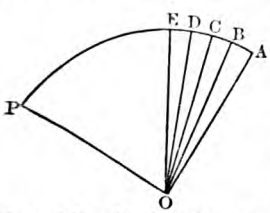


Fig. 17.—To find the area of a sector of a circle.

The area of each of these triangles $= \frac{1}{2}$ base × height.

The height of each = radius r.

Hence the sum of the areas $= \frac{1}{2} r$ (A B + B C + C D + D E + . .)

$= \frac{1}{2} r \times$ arc A P.

Hence **area of sector** $= \frac{1}{2} \times$ **radius** × **arc.**

If θ be the circular measure of the angle A O P then arc A P $= r\theta$

$\therefore$ **area of sector** $= \frac{1}{2} r \times r\theta$

$= \frac{r^2\theta}{2}$

18. *To find the area of a segment of a circle.*

(i) Let the segment A C B be less than a semicircle. Find O, the centre of the circle. Join O A, O B.

Then area of segment A C B

= area of sector O A B — area of triangle O A B.

Draw B D perpendicular to O A and produce to cut the arc B C A produced in E.

Area of segment A C B

$= \frac{1}{2}$ arc A C B × radius $- \frac{1}{2}$ B D × radius

$= \frac{1}{2}$ radius (arc A C B − B D)

$=$ **$\frac{r}{2}$ (arc A C B $- \frac{1}{2}$ chord of double arc A C B)**

(ii) Let the segment A C B be greater than a semicircle.

Then **area of segment A C B**

= area of sector O A B + area of triangle O A B

$=$ **$\frac{r}{2}$ (arc A C B $+ \frac{1}{2}$ chord of double arc A F B)**

Again:

In case (i) let the circular measure of angle A O B $= \theta$.

Then **area of segment A C B**

= area of sector A O B — area of triangle A O B

$= \frac{r^2\theta}{2} - \frac{1}{2}$ A O . B D

$= r^2\theta - \frac{1}{2} r \times r \sin\theta$

$=$ **$\frac{r^2}{2}$ (θ − sin θ).**

And in case (ii)

Area of segment A C B

= area of sector A O B + area of triangle A O B

$= \frac{r^2\theta}{2} + \frac{1}{2}$ A O . B D $= \frac{r^2\theta}{2} + \frac{1}{2} r \times r \sin(2\pi - \theta)$

$= \frac{r^2\theta}{2} + \frac{r^2}{2} (-\sin\theta) =$ **$\frac{r^2}{2}$**(θ − sin θ).

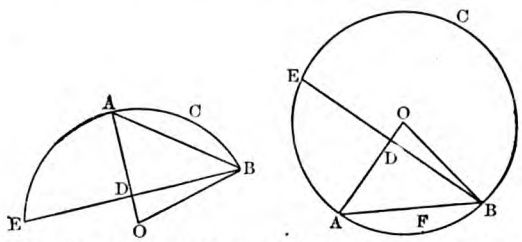


Fig. 18.—To find the area of a segment of a circle.

The student should note that in this case θ is greater than π.

19. *To find the radius of a circle having given the height of an arc and the chord of the arc.*

Let C D = height of arc A C B $= b$.

Let A B, the chord of the arc A C B, $= c$.

Let the radius of the circle $= r$.

Then if O be the centre of the circle, O D $= r - b$.

Since ∠ A D O is a rt. ∠ $\therefore$ O A^2 = A D^2 + D O^2

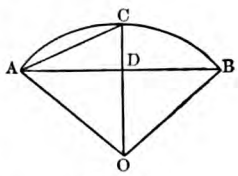


Fig. 19.

$\therefore r^2 = \left(\frac{c}{2}\right)^2 + (r - b)^2 = \frac{c^2}{4} + b^2 - 2rb + r^2$

$\therefore 2rb = \frac{c^2}{4} + b$

$\therefore$ **$r = \frac{c^2 + 4b}{8b}$**

20. *To find the radius of a circle having given the height of an arc and the chord of the semi-arc.*

In the fig. of § 19, let C D, the height of arc A C B, $= b$.

Let A C, the chord of the semi-arc, $= d$.
Let the radius of the circle $= r$.
Then $O A^2 = A D^2 + D O^2 = A C^2 - C D^2 + D O^2$
$\therefore r^2 = d^2 - b^2 + (r - b)^2$
$= d^2 - b^2 + r^2 - 2rb + b^2$
$\therefore 2rb = d^2$

$$\therefore r = \frac{d^2}{2b}$$

21. *To find the length of the chord of an arc having given the height of the arc and the radius of the circle.*

From § 19 we have
$c^2 = 8rb - 4b^2 = 4b(r - 2b)$

$$\therefore c = 2\sqrt{b(r - 2b)}.$$

22. *To find the radius of a circle inscribed in a triangle.*

Let I be the centre of the circle inscribed in △ A B C.

Let D, E, F be the pts. where the circle touches the sides B C, C A and A B respectively.

Then I D, I E and I F are perpendicular to the sides B C, C A, A B respectively.

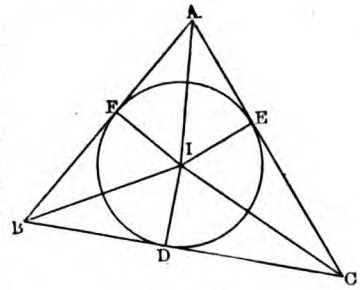


Fig. 20.

Let r = radius of the circle = I D = I E = I F.
Let S = area of △ A B C.
Let $2s$ = A B + B C + C A.
△ A B C = △ I B C + △ I C A + △ I A B.
$\therefore S = \frac{1}{2}$ B C . I D + $\frac{1}{2}$ C A . I E + $\frac{1}{2}$ A B . I F
$= \frac{1}{2} r$ (B C + C A + A B)
$= rs$

$$\therefore r = \frac{s}{S}.$$

23. *To find the radius of a circle escribed to a triangle.*

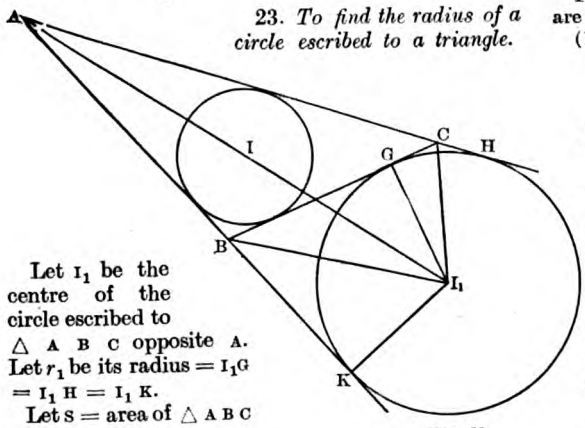


Fig. 21.

Let I_1 be the centre of the circle escribed to △ A B C opposite A.
Let r_1 be its radius = I_1G = I_1 H = I_1 K.
Let S = area of △ A B C and $2s$ = A B + B C + C A.

△ A B C = △ C I_1 A + A I_1 B − △ B I_1 C
$\therefore S = \frac{1}{2}$ C A . I_1 H + $\frac{1}{2}$ A B . I_1 K − $\frac{1}{2}$ B C . I_1 G
$= \frac{1}{2} r_1$ (C A + A B − B C)
$= r_1 (s - a)$ (denoting B C by a as usual).

$$\therefore r_1 = \frac{S}{s - a}.$$

Similarly, if r_2 and r_3 are the radii of the escribed circles opposite B and C respectively,

$$r_2 = \frac{S}{s - b} \text{ and } r_3 = \frac{S}{s - c}$$

24. *To find the radius of a circle circumscribed about a triangle.*

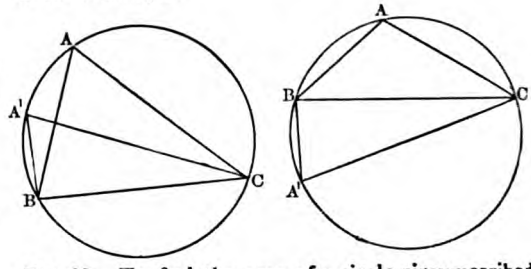


Fig. 22.—To find the area of a circle circumscribed about a triangle.

Let R be the radius of the circle circumscribed about △ A B C and let C A′ be a diameter.
Join A′ B.
Then ∠ C B_1 A^1, being an angle in a semi ○, is a rt. ∠.
Also ∠ B A^1 C = ∠ B A C in Fig. (i)
and ∠ B A^1 C = π − ∠ B A C in Fig. (ii).
$\therefore$ B C = C A′ sin B A′ C = C A′ sin B A C
i.e. $a = 2R \sin A$.

$$\therefore R = \frac{a}{2 \sin A}.$$

Now S = area of △ A B C = $\frac{bc}{2} \sin A$

$$\therefore \sin A = \frac{2s}{bc}$$

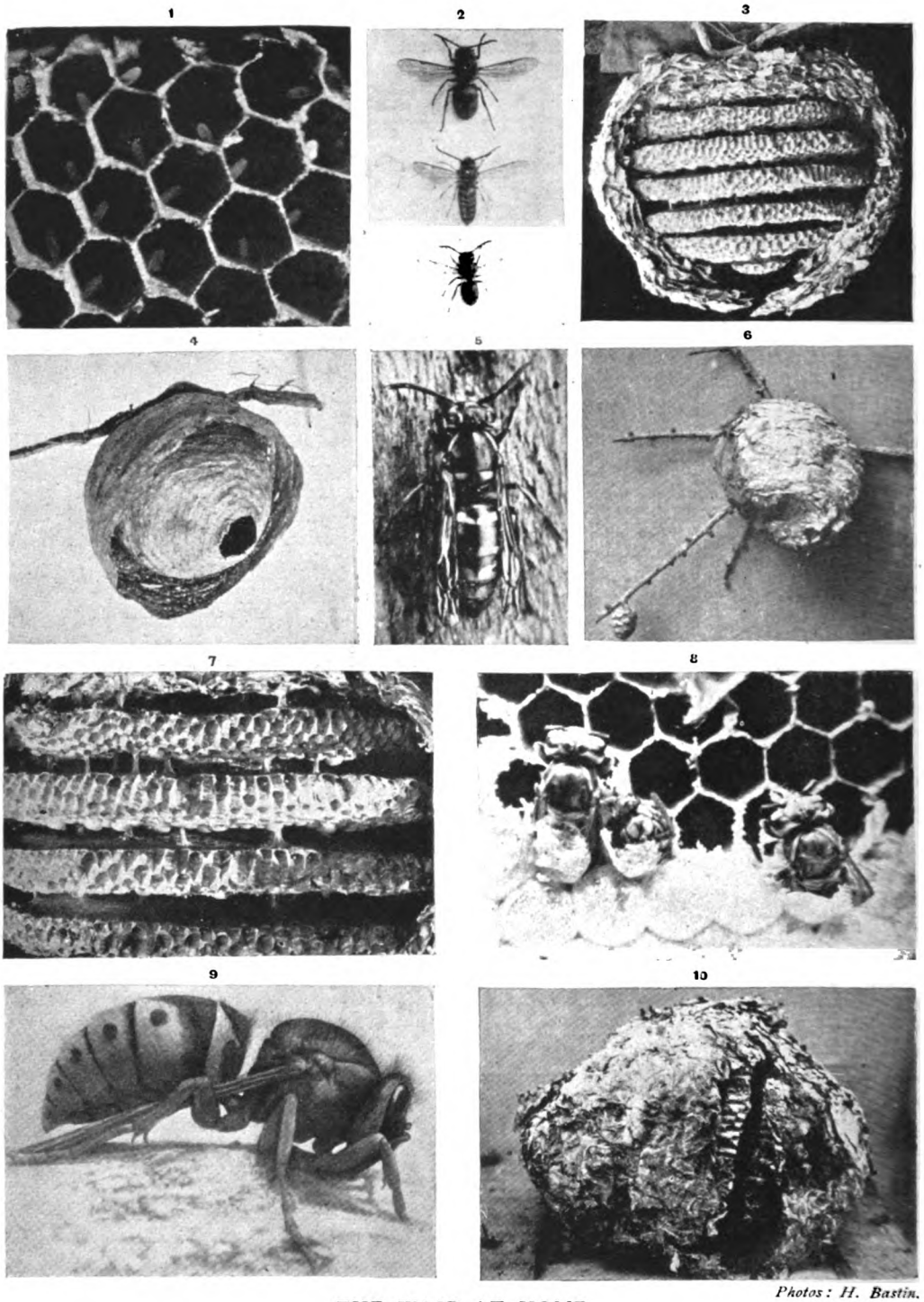
$$\therefore R = \frac{abc}{4S}.$$

Exercise 2

Find the circumference of the circles whose radii are:
(1) 10 in. (2) 2 ft. 6 in. (3) 4 yds. 2 ft. 3 in.
Find the area of the circles whose radii are:
(4) 2 in. (5) 10 ft. (6) 1·5 miles.
(7) Find the area of the annulus the radii of whose outer and inner circumferences are 3 yds. and 7 ft. 8in.
(8) Find the area of the sector of whose radius and angle are 12 ft. and 60° respectively.
(9) Find the area of a segment of a circle whose radius is 12 ft. where the angle subtended at the centre by the arc is 30°.
Find the radii of the following circles, having given:
(10) Height of arc 10 in:, chord subtending it 60 in.
(11) Height of arc 2 in., chord subtending semi-arc 8 in.

Key to Exercise 1

(1) 425 sq. yds. (2) 238 sq. ft. 90 sq. in. (3) 1 acre 20 poles. (4) 77 yds. (5) 32 ft. (6) 220 yds. (7) (i) 72 sq. ft. (ii) 77 sq. ft. (iii) 6 sq. ft. 108 sq. in. (8) (i) 108 sq. in. (ii) $\frac{1}{2}(a^2 - b^2)\sqrt{2}$ (iii) $704\sqrt{3}$ sq. yds. (9) 221 $\frac{11}{21}$ yds. (10) 182250. (11) $2\frac{1}{4}$ sq. ft. (12) $\frac{a^2 - b^2}{4}$. (14) 25 in. (15) 65 sq. in. (16) 8 ft. (17) 75 sq. ft. (18) $32\sqrt{3}$ sq. ft.; $16(3 - 2\sqrt{3})$ ft. M. A. L.



Photos: H. Bastin.

THE WASP AT HOME.

1. Eggs laid (one in each cell) by Queen wasp; 2. Queen, drone (male), and "worker" or common wasp; 3. A wasps' nest with part of the outer cover removed; 4 and 6. Wasps' nests suspended from trees: not all wasps build underground; 5. Queen wasp rasping wood fibres from a fence; 7. Interior of a nest, showing how combs are suspended; 8. Young wasps emerging from their cells; 9. Queen wasp, hibernating; 10. A nest removed from the nest hole. (*See* page 274.)

Continued from page 184.

BUSINESS AND COMMERCE:

***Contributors*:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).**

COMMERCIAL TRAINING.—XXXVIII

OF the different types of insurance business perhaps the most common has to do with fire. In these days, no business man would think of neglecting his fire insurance policy. The cover afforded and the rules drawn up have reached such a state of commercial perfection that there is no excuse for being neglectful.

Curiously enough, it is to one of the holocausts of history that we actually owe fire insurance. Prior to the Great Fire of London (1666) there was no such institution; but, as the outcome of that disaster, men of business grouped themselves together and evolved the idea of paying individual contributions to a common fund, from which a member might draw money to meet losses by fire. From that beginning there sprang up at the time many fire insurance companies; and it is interesting to note that some of them at least are in existence to this very day.

Fire Insurance

One of the first points to be considered with regard to fire insurance is that up to whatever amount one cares to insure, the liability of the company is limited to the actual current value of the articles damaged or destroyed by fire. One might have a policy for £200 upon articles to the value of £150; but, in the event of the articles being destroyed by fire, the insuring company would only pay up to £150 and not to £200, even though premiums for the latter amount had been charged year after year.

The basis of all fire insurance business is the Proposal Form. Blank forms are provided by the companies; and, when filling in a form, the greatest possible effort should be made to ensure complete accuracy and to make no attempt whatever to withhold any vital information that is asked for. If, at a subsequent claim, it could be proved that the proposal form was not filled up honourably the company would be perfectly justified in disregarding their liability, if not in cancelling the policy out of hand.

Thus, when insuring a business it is necessary that the precise risks shall be set forth on the proposal form; the average stock-in-trade of the business; the value and situation of plant and machinery; particulars of fixtures; and so on. In the case of large businesses, where insurance is effected for considerable amounts, one or more representatives of the insurance company will go over the building and check off the items on the proposal form.

Household Policies

With regard to private houses, the risks usually accepted by insurance companies apply to household goods (including provisions, stores, linen, wearing apparel, cycles, furniture, carpets, curtains, printed books, china, glass, musical instruments, clocks, pictures, and so on); but it is an understood thing that works of art of high commercial value—£12 10s. is usually taken as the standard up to which ordinary insurance goes—should be separately and specially insured.

In such cases, the property must belong to the insured person, to members of his family and servants, and must be contained in the house. Cycles kept in a shed away from the house, garden tools and similar outdoor effects, are *not* covered unless they be specified first in the proposal form and then in the policy.

Further, a person may only insure those things in which he possesses a pecuniary interest. He must indeed be the actual owner, or at all events a trustee, or have a mortgage interest in the property before he can insure it. Thus, a man conducting a business on premises that were his own property would take out a policy on the

building and another on the business; or, at all events, a combined policy for the joint risk. Were he merely a tenant, conducting his business in a leased building, it would be necessary for him to insure his own goods and chattels, and the rent of the building, leaving the landlord to insure the building itself.

The reason for insuring the rent is that by English law a tenant is compelled to pay rent for premises during the term of his lease or agreement in whatever eventuality. Thus, if a building were burned to the ground it would be incumbent upon the landlord to re-erect it in the shortest possible space of time; but, in the meanwhile, the tenant would be liable for all the rent under his lease. In Scotland this law does not pertain.

Conditions Governing Premiums

Moreover, in the case of a man carrying on his business in leased premises it will be necessary for him to safeguard himself against loss of profits caused by the burning down of the building; and this contingency may also be provided for by fire insurance.

We may imagine, then, that the proposal form has been handed in and that, if necessary, a surveyor or other representative of the particular insurance company has inspected the building, the stock and other goods to be insured. The next stage will be a quotation of rate of premium, and this is dependent upon many circumstances. So far as private residences go, it is usual to make a charge of 1s. 6d. per £100 on the building; and of a trifle more per cent. upon the contents. Thus, by paying a premium of, say, 2s., household and domestic effects to the value of £100 are insured. But it is not sufficient to take out a policy for £100 when goods to the value of £300 are involved; nor should a policy for £400 be taken out on goods worth only £300.

By far the wisest plan is to make a liberal valuation of the contents of the house, and then to take a policy leaving a slight margin —say £50—partly to cover any additions that may be made. It is wise, also, to compile some sort of an inventory of the contents of a house, so that, should it be necessary following upon a fire to prove what has been destroyed, the inventory (kept at a bank for safety) might be produced.

With businesses it is different. Some trades are far more risky than others, concerned with goods of a more inflammable nature. We would point out also, that fire risks are dependent not only upon the building concerned, but also upon those grouped round it.

At the same time, all these risks have been tabulated and analysed by the actuaries to the insurance companies, and the rates fixed by one company will be practically the same as those of another. And in due time, following upon the proposal, these rates will be quoted, possibly subject to the installation of some safety appliance, and the insurer pays the initial premium.

For this payment he receives a receipt, which affords him cover or insurance from the date of payment; and, after the lapse of a week or two, the full policy will be given. And this document is not one to be cast aside. The proposal form, the basis of the contract, is of the greatest importance, but the policy is of even greater and should be read over, particularly as it applies to special slips pasted on, to ascertain that it carries out the intention of the insurer.

In most cases fire insurance is arranged by the year and the renewals become payable annually, 15 days of grace being generally allowed.

Fire and Burglary

Following upon a fire, the first step should always be to report the matter in writing to the insurance company, and to lodge a formal claim specifying in detail the quantity and value of the articles destroyed or damaged. The scene of the fire will then be visited by an inspector from the insurance company and the insured will be called upon to prove his loss; always remembering that, just as the proposal form is the basis of the policy, so the formal notice given after a fire is the basis of the claim.

Burglary insurance is a comparatively cheap way of protecting oneself against loss caused by thieves and marauders; but it must be remembered that by law a theft to be a burglary must occur between the hours of 9 p.m. and 6 a.m. and must be the outcome of forcible entry. Between the hours of 6 a.m. and 9 p.m. the crime of entering premises forcibly to steal is known technically as "house-breaking," and the scale of punishment for the two offences is totally different. When goods are stolen from premises without forcible entry the offence is known merely as larceny or plain theft.

When arranging insurance business, therefore, to cover these eventualities it is highly advisable to secure a policy for burglary, house-breaking and larceny. And, as an additional cover, the insured should be guaranteed from loss by damage caused to

From the mural painting in the Royal Exchange by Stanhope Forbes, R.A.

THE GREAT FIRE OF LONDON, 1666,

gave rise to the idea of fire insurance, i.e. to the idea that men should group themselves together and pay money into a common fund from which the individual might draw money to meet losses by fire.

his property or the premises by the actions of a thief.

In business premises the charges made for burglary insurance vary considerably with the type of trade carried on, the nature and situation of the building, whether there is a resident caretaker and such matters. For the purposes of this type of insurance the trades are classed, a special rate being applicable to each class, jewellers being charged at the highest rate.

The effect of Fidelity Insurance is to give to an employer a guarantee as to the honesty of an employee. Forgery, theft, embezzlement and such offences as involve the loss of actual money and securities come under this heading.

A rate collector or other person handling large sums of money is frequently called upon by his employers to furnish some sort of actual guarantee as to his fidelity. In such instances, it is better to have the guarantee of an insurance company than that of a private individual; and this forms another branch of insurance. A. B.

CHOOSING A CAREER.—XLIII

Horticultural Sundriesmen. — In most areas there is an opening for the tradesman who specialises in garden sundries, tools, bast, bamboo rods, appliances, seeds, bulbs and so on. Most of the men engaged in this trade have an insight into practical gardening; and anyone wishing to take up the calling should serve some time as a gardener and then seek a situation as shop assistant.

Horticultural Teachers.—In connection with most of the county and borough councils there are appointed teachers of gardening. Some of them are residential masters or mistresses in charge of the school garden; but others merely attend at given times for the purposes of their lesson. The best training ground is a horticultural college, (of which there are many in all parts of the country) and a knowledge of botany is important.

Hotel Keepers.—In this business there is much to be learned, and a worker must inevitably give many years to the gaining of experience. There are equal openings for men and women; and the matters to be most closely studied are the purchasing of supplies, the keeping of accounts and the management of the staff.

A sound family and commercial hotel not entirely dependable upon the seasons is the most steady proposition; and the greatest attention must be paid to the comfort of the commercial men. Hotels at pleasure and health resorts are naturally more precarious in their rewards. A temperance hotel can be made most profitable, and this is a field specially open to the woman worker.

Hudson Bay Workers.—At one time there was a considerable opening for workers from the mother country in the service of the Hudson's Bay Company; but, nowadays, vacancies fall very largely to native-born Canadians more inured to the rigours of the climate. Occasionally, however, young men from home are appointed, and those who are interested should write for information to the *Secretary of the Hudson's Bay Company, Lime Street, London, E.C.*3.

Indexers.—Both men and women of education and letters are employed in the work of preparing indexes for books. Application should be made to the various publishing houses, but the rate of remuneration is dependent very largely upon the nature of the book that is to be indexed. Some publishers retain a permanent staff of expert indexers at a fixed salary.

Ironmongers.—No tradesman carries so large and mixed a stock as an ironmonger, and the period of the annual stock-taking is dreaded by every assistant. For this reason, it requires an unusually large capital to buy or to start such an establishment; but the profits on each individual transaction are probably higher than those in any other of the ordinary trades.

But, besides his profits upon the sale of tools, general ironmongery, firegrates, nails, screws and so on, the tradesman must look for considerable remuneration from repairs; and, with this end in view, should establish adjacent to his shop a work-place for the purpose.

In the country an ironmonger serves an apprenticeship of seven years, paying a small premium for the privilege of being taught his business. In many instances apprentices live in. After this period a worker becomes first an improver, then an assistant and eventually perhaps a manager.

Iron Workers.—In connection with large iron works there is an opening for all sorts of labour. At the very top there is the manager of the factory; then the chemist metallurgist; then the buyers of fuel and other raw materials; the highly paid staff that arranges for the booking of orders and sale of commodities and the general office staff. A youth entering such an office in a minor capacity and adapting himself by self-education or by attending technical classes

might well qualify for some of the highest positions of executive rank.

In the lower grades there are the firemen, labourers, iron plate workers, smelters, drawers, strikers, and many others; each paid according to his capacity.

Jewellers. — It is seldom that this business is followed in a retail sense as an independent calling, though there are wholesale jewellers who deal in the one line of goods. These men, together with diamond merchants, are mostly in business in the Hatton Garden district of London; and a man who has started as a junior assistant and by perseverance gained a close knowledge and valuable insight into the purchase and sale of jewels can command a very high salary.

In a retail sense, jewellers usually combine the business with that of the goldsmith and silversmith. In some districts a system of apprenticeship prevails, but in others juniors commence as paid learners. The apprenticeship system is naturally the better, because the majority of retail jewellers are dependent more upon repairs than upon sales. With the better class shops a considerable premium is charged for apprenticeship; but the skilled craftsman can earn very good wages.

King's Messengers.—The work of these trusted officials consists of carrying important and confidential dispatches between our different embassies. Men of proven courage, usually retired military officers or ex-members of the Royal Household, are selected for the duties.

Leather Workers.—In the work of preparing hides and skins for commercial use the tanning yard comes into play, and tanners are highly skilled workers. Boy learners begin at a trifling wage and serve for about five years before becoming tanners' labourers. In London the chief tanneries are in the Bermondsey district.

Saddlers and harness makers serve a lengthy apprenticeship and in country districts often live in. Birmingham is the centre of the saddlery and portmanteaux trades in the provinces. A. C. M.

BOOK-KEEPING.—XXXVIII

THE student's attention is called to the five following questions which constitute a valuable

General Test

Not more than three hours should be occupied in working this test. Full solution to these questions will be found in the next Lesson, p. 436 *et seq.*

Question 1.—From the following Trial Balance prepare Departmental Trading Accounts, General Profit and Loss Account, and Balance Sheet. "C" is a new department opened during the year.

TRIAL BALANCE—DECEMBER 31, 19...

	£	s.	d.	£	s.	d.
Philip Sims, Capital Account				3,000	–	–
,, Drawing Account	2,500	–	–			
,, Loan Account	1,500	–	–			
Sundry Creditors				2,900	–	–
Sundry Debtors	3,200	–	–			
Freehold Factory	2,500	–	–			
Mortgage on Factory				2,000	–	–
Plant and Machinery	2,500	–	–			
Bank—Overdraft				300	–	–
Cash in Hand	50	–	–			
Purchases, "A" Department	2,400	–	–			
,, "B" ,,	1,100	–	–			
,, "C" ,,	4,600	–	–			
Wages, "A" Department	850	–	–			
,, "B" ,,	500	–	–			
,, "C" ,,	200	–	–			
Sales, "A" ,,				6,150	–	–
,, "B" ,,				4,900	–	–
,, "C" ,,				7,900	–	–
Salaries	750	–	–			
General Expenses	850	–	–			
Rates and Lighting	250	–	–			
Discount				300	–	–
Bad Debts	200	–	–			
,, Reserve				500	–	–
Stock, January 1, 19.., "A" Department	1,000	–	–			
,, ,, ,, "B" ,,	3,000	–	–			
	£27,950	–	–	£27,950	–	–

The Stock on December 31, 19.., was:—

"A"	Department ..	£1,450
"B"	,, ..	£1,300
"C"	,, ..	£900

Provide 10 per cent. depreciation on the Plant and Machinery. Interest for six months at 4 per cent. per annum is due on the Mortgage and should be taken into account.

Question 2.—Describe briefly how you would convert a set of books, which had been kept on "Single-entry" methods, into the "Double-entry" system.

Question 3.—Abrams, Brown and Collins are partners in the firm of Abrams and Company, whose books are kept by single entry. On December 31, 19.., the balance in favour of the firm was £10,000, divided thus:—

Abrams	£5,000
Brown	£3,000
Collins	£2,000

On December 31, 19.., their assets amounted to £30,000 and their liabilities to £16,000, the balance in favour of the firm being £12,000. The drawings for the year 19.. were: Abrams, £1,000; Brown, £600; and Collins, £400.

Profits and losses are divisible:—

Abrams	5 tenths.
Brown	3 tenths.
Collins	2 tenths.

Show the amounts at the credit of each partner's account on December 31, 19.., and show how you arrive at such amounts.

Question 4.—What is the chief difference between a "Receipts and Payments Account" and an "Income and Expenditure Account"? In what undertakings are these forms of accounts respectively made use of?

Question 5.—The Biscoe Manufacturing Company has an authorised capital of 24,000 Ordinary Shares of £5 each. Its Trial Balance taken out on December 31, 19.., was as shown at foot of this page.

You are required to prepare a Trading Account, a Profit and Loss Account and Balance Sheet, making the following adjustments:—

Depreciation on Land & Buildings at 3 per cent.
,, ,, Machinery & Plant ,, 6 ,,
,, ,, Loose Tools ,, 10 ,,
,, ,, Patents ,, 10 ,,
,, ,, Fixtures & Fittings ,, 5 ,,

Make a reserve of 5 per cent. on Sundry Debtors for Bad Debts.

Carry £90 insurance forward.

Charge £723 5s. for Directors' fees.

Charge £1,826 for Managing Director's remuneration.

Appropriate £2,500 to Reserve Account.

Reserve £50 for Audit fee.

Stock at December 31 was agreed as £30,020.

The foregoing questions which constitute the General Test are based on the principles of book-keeping inculcated throughout the course, and are representative of the accredited and typical practice obtaining in the modern counting-house. Consequently the student who has thoroughly grasped the significance of the preceding lessons should have no difficulty in satisfying the examiners on the questions set before him, and exchanging his experience for the emoluments of the labour market.

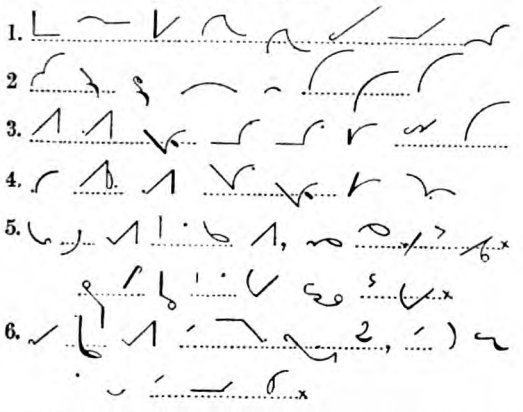
TRIAL BALANCE—DECEMBER 31, 19...

	£	s.	d.	£	s.	d.
Capital issued and fully paid up, 18,000 shares of £5 each ..				90,000	–	–
Cash in Hand	168	–	–			
Cash at Bank	552	–	–			
Purchases	71,437	–	–			
Sales				165,395	–	–
Sales Returns	1,222	–	–			
Purchases Returns				934	–	–
Manufacturing Charges	11,500	–	–			
,, Wages	31,952	–	–			
Salaries	2,450	–	–			
Trade Expenses	7,101	–	–			
Rates and Taxes	492	–	–			
Insurance	244	–	–			
General Expenses	3,021	–	–			
Discounts	1,900	–	–			
Bad Debts	972	–	–			
Interest and Bank Charges	350	–	–			
Land and Buildings	22,250	–	–			
Machinery and Plant	35,600	–	–			
Loose Tools	2,360	–	–			
Office Fittings and Fixtures	680	–	–			
Sundry Debtors	57,640	–	–			
Bills Payable				4,380	–	–
Sundry Creditors				26,052	–	–
Patents	5,000	–	–			
Bad Debts Reserve (January 1, 19..)				2,600	–	–
Profit and Loss (Balance, January 1, 19..)				750	–	–
Reserve				6,000	–	–
Stock at January 1, 19..	39,220	–	–			
	£296,111	–	–	£296,111	–	–

F. H.

SHORTHAND.—XXII

Key to Exercise 78



Special Contractions.—In a previous lesson we dealt with what are termed *General Contractions*, i.e., contractions which are formed by omitting a medial consonant, or consonants, or the termination of a word, in order to avoid a lengthy outline or an awkward joining. The student will no doubt have learned from experience the very helpful nature of this method of abbreviation, and in this Lesson it is our intention to refer briefly to further methods of contracting outlines. To emphasise the importance of contractions, it might here be mentioned that in ordinary language a comparatively limited number of words are used, and of these words it is estimated that from 60 to 70 per cent. are of frequent occurrence. Such words are, therefore, included in the Grammalogues and Contractions of Pitman's Shorthand

Special Contractions are formed in the following ways :—

(a) By writing only the first two or three strokes of the full outline. (b) By medial omission. (c) By employing logograms. (d) By intersection.

It is impossible in the space available to give full lists of the contractions formed by these methods, but we give a brief selection of those coming under each of these heads.

(a) *peculiar-ity,*
perform-ed,
performs-ance,
public or *publish-ed,*
probable-ly-ility,
proficient-ly-cy,
platform,
observation,
subscribe-d,
subscription,
deficient-ly-cy,
difficulty,
discharge-d,
distinguish-ed,
advertise-d-ment,
January,
character,
characteristic,
expenditure,
esquire,
immediate,
inform-ed,

(b) *telegraphic,*
telegram,
satisfactory,
minimum,
English,
influential,
acknowledge,
acknowledged,

(c) *altogether,*
together,
everything,
something,
anything,
nothing,
remarkable-ly,
whatever,
whenever,

(d) *misfortune,*
notwithstanding,
incandescent,
incandescence,
enlarge,
enlarged,
enlargement,
inconvenient-ce,
nevertheless,

Pitman's *Vest Pocket List of Grammalogues and Contractions* (2d.) should be obtained, as this contains the full lists of these speed-producing outlines. The student who sets about the task of memorizing these contracted forms in systematic fashion will be surprised at the ease with which it can be accomplished, and in the end he will be amply repaid.

A good plan to adopt is as follows:—Take a sheet of foolscap paper, and write the words (taking a page of the Vest Pocket List at a time) down the left-hand side in a narrow column made by creasing the paper. Then, in a second column, fill in the shorthand equivalents from memory as far as possible, referring to the printed list when necessary to supply omissions. Now fold the first column out of sight, and in a third column write the longhand words again *from the shorthand* (referring to the first column or the printed list when in doubt). Next fold the second column back out of sight, and continue the process indicated until the sheet is filled. By that time the list will no doubt have been memorized.

Advanced Phraseography.—The general principles of phraseography have already been dealt with, and the student is therefore familiar with a large number of ordinary phraseograms. The application of abbreviations and contractions may, however, be further extended, and we now propose to deal briefly with the more advanced methods of phrasing.

It should be borne in mind that phrasing is an art, and not simply the joining together of as many words as possible. Phrasing, as properly understood, implies the joining together of word forms suitable for swift transference to paper, and with the additional virtue of being readable at a glance. This applies to simple phrasing as well as to advanced phrasing, where a certain amount of contraction is employed.

The principles of phraseography may be considered under the following heads, and the examples

given are merely suggestive of the manner in which these rules may be applied.

(a) Circles, Loops and Hooks. (b) Halving. (c) Doubling. (d) Omissions.

(a) THE SMALL CIRCLE, which in the ordinary way represents *as, has, is, his,* may also be employed for the representation of the word *us,* as in

from us, to us, please let us know.

THE LARGE CIRCLE may be used thus:—(1) Initially only, to represent *as we,* as in *as we can, as we have*; or *as w-* in *as well as.* (2) To represent *s-s, s-z* (including grammalogues represented by circle *s*), thus —

in this city, it is seen, this is.

THE ST LOOP may be used for *first,* as in

at first, Monday first.

THE R AND L HOOKS are employed to represent a number of miscellaneous words, as in—

in our, by all, it is only necessary.

THE N HOOK may be used for the following words: *than,* as in *more than, better than; been,* as in *have been, I had been; own,* as in *your own, her own* (note, however, *my own,* to avoid confusion with the outline *mine*); *on,* as in *carry on.*

THE F OR V HOOK may be employed to represent the following words: *have,* after a straight sign written in the same direction as the stroke /, thus— *which have, who have* (note *can have*); *of,* as in *out of, state of things; after-,* as in *Wednesday afternoon*; *even-,* as in *Wednesday evening*; and in a few miscellaneous phrases, as *into effect, at all events.*

THE CIRCLE S AND SHUN may be used for *association,* as in *Medical Association,* while the SHUN HOOK may represent *ocean,* as in—

Atlantic Ocean.

(b) THE HALVING PRINCIPLE may be employed to represent the following words: *it, to, not, would, word, out,* as in *if it is, unable to, if it be not, this would be, every word, carried out.*

(c) THE DOUBLING PRINCIPLE may, subject to the ordinary rules for its application, be employed to represent the addition of *there* and *their,* as in—

in their way, been there; it may also be used to represent *other* and *dear,* as in *some other, one or other, my dear sir.*

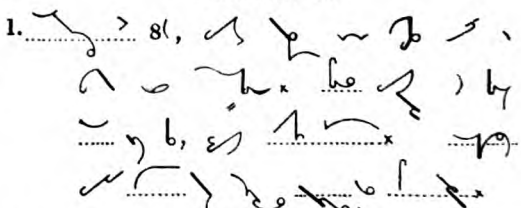
(d) The omissions which are allowed in Phraseography may be arranged under three heads: (1) Consonants, (2) Syllables, (3) Logograms. The following miscellaneous examples are suggestive of the wide range of phrasegrams that may be formed in this manner:—

bes(t) time, in (f)act, in (r)eply, I will (con)sider, we have (con)cluded, ladies (and) gentlemen, more (or) less, there must (have) been, two (or) three, point (of) view, what is (the) matter, as (a) rule, needless (to) say.

Students are strongly recommended to complete their knowledge of phraseography from *The Phonographic Phrase Book* (Pitman). This book, in addition to a long introduction dealing exhaustively with the principles of phrasing, contains over 2,500 phraseograms, a working acquaintance with which would result in a very considerable increase in speed.

The knowledge gained from the rules given in this Lesson will enable the student to transcribe the following Exercise into longhand. The key will be given in the next Lesson.

Exercise 79

1. 
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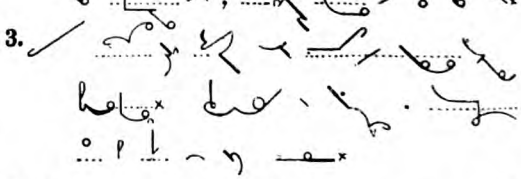
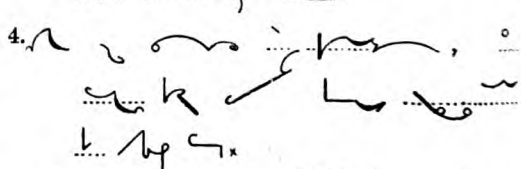
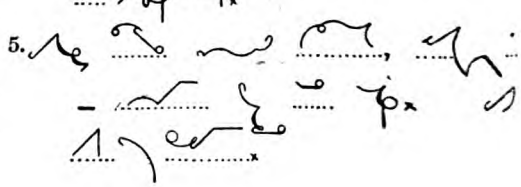
3. 
4. 
5. 

Continued from page 192.

ENGLISH LANGUAGE AND LITERATURE:

Contributors:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

POLITICAL ECONOMY.—VI

ALTHOUGH Economists do not agree as to the exact part played by labour in the production of wealth, yet none disputes the necessity of labour or denies that it is entitled to its fair reward. As we have already seen, the share which it takes is called "wages." During the last century vast improvements have been made in the conditions of the working classes both as a result of combinations in the various trades and by legislation.

These improvements will continue as civilisation advances, but it is highly improbable that wages will ever rise to a level which will be entirely satisfactory as progress creates new wants and desires, and these have to be met as they arise The desire and demand is invariably in advance of the supply.

Trade Unionism

The trade union movement has been a most powerful means not only for raising wages, but for shortening the hours of labour and creating improved conditions; but like all other organisations, while aiming at beneficial results, has created conditions sometimes beneficial to the workman, at other times to his apparent disadvantage.

We shall review the various measures and steps taken with the object of improving the condition of the working classes as concisely as possible and leave the reader to form his own conclusions as to their effect.

The introduction of machinery and its very rapid growth brought about a great change in the industrial system, and instead of the master and his men working together at the same bench, and on friendly terms, a gulf was made between them. The handworker could no longer compete with machinery and the factory system grew rapidly, and the close relationship between master and man dropped out, labour began to feel itself estranged from capital and began to regard the capitalist as an enemy and formed unions or combinations to enforce the rights of the workers.

In 1799, however, the Combination Act was passed and reaffirmed in the following year, making it an offence punishable with imprisonment for workers to combine to obtain higher wages, decreasing the hours of labour or for obtaining improved conditions.

Repeal of the Combination Act

This arbitrary law, however, did not succeed, it only increased the determination of the workers to prosecute their rights; and while a large number of leaders suffered imprisonment, the agitation was carried on. The violence of the law was met with violence and neither life nor property was safe.

Constant agitation compelled the repeal of the Combination Act in the year 1824. In the following year, 1825, the Act of 1824 was repealed, and it was provided that combinations were subject to the common law of conspiracy, "but Associations formed for the express purpose of regulating wages and hours of labour" were expressly exempted from prosecution. This is the foundation of the existence of trade unions.

The struggle between capital and labour then commenced. The workers demanded the parliamentary vote, which was eventually given, and at the present time the trade unionist is represented in the House of Commons and on all local Councils. The true functions of a trade union are to provide funds by means of subscriptions to pay to its members Sick Benefits, Unemployment

Grants, Funeral Benefits, and to combine for the purpose of raising wages and shortening hours either by negotiation with the employer or by a strike when necessary, and to maintain a fund for the support of its members during a strike.

Some of the older trade unionists contend that when a trade union goes farther than those functions it is going outside its legitimate purposes and objects. There appears to be very little doubt that in some cases trade unionism has been carried to the border line of tyranny.

It is contended that a man is a free agent and should be allowed to exercise his own judgment as to whether he will join a trade union or remain the arbiter of his own destiny. The trade unionist, however, contends that by the combined action of its members wages have been raised, and a non-unionist has no right to participate in these advantages unless he is prepared to support the union by becoming a member and contributing to its funds, and in many cases a non-unionist is unable to get employment unless he becomes a member of a union, the trade unionist declining to work with a non-unionist.

The Right to Strike

An impartial survey of the economic situation during the last 50 years seems to point to the necessity of the working man having the right to strike, and of his using this weapon to enforce his right to a larger share in the distribution of wealth.

A man's ability to work is his only capital, and he has a right to deal with that capital in any way he may think fit.

He has a right to sell his labour in the best market so long as he does not interfere with the rights and liberties of others; but in respect of the trade unionist the law has given the control to the majority.

Statistics, however, show that taken over a number of years, wages have been raised more as a result of negotiation between the master and the workman than they have by strikes, while the loss to the nation through strikes during the first twelve years of the twentieth century has been far greater than the benefits received.

In the year 1912 according to the Board of Trade Report, over 40 million working days were lost and over 15¾ million pounds were lost in direct wages, while the total increase of wages which was not all the result of the strikes was less than 135 thousand pounds a week.

The Conciliation Acts of 1867 and 1896 were passed to facilitate the establishment of equitable Councils of Conciliation to adjust differences between masters and men. These Conciliation Boards have undoubtedly tended to reduce the number of strikes.

Most of the measures which have been passed to improve the condition of the working classes may be attributed directly or indirectly to the trade union influence, among which may be mentioned the abolition of the Truck System, The Regulation of Factories and Workshops, The Housing of the Working Classes, The Public Health Acts, The Friendly Societies Acts, The Conciliation Acts, The Trades Disputes Act or District Minimum Wage, Fair Wage Clauses to be inserted in Government and Municipal Contracts, The Coal Mines (Minimum Wage) Act, The Trade Boards Act which applies to sweated industries.

Although we have said that this legislation may be attributed directly or indirectly to the trade unions it must not be taken that the trade unions have either advocated or supported all these measures; indeed in some cases the unions have offered the strongest opposition. Trade unionists have however demanded reforms, and these measures have been the result of such agitation.

Truck Acts

The Truck Acts were passed for the purpose of preventing the payment of wages in goods or kind and to compel payment in current coin of the Realm only. The reason for the passing of this Act was to give the workman greater freedom and to prevent the master from making a profit out of the workman's wages.

There were two reasons for the passing of the Factory Acts, the first being the protection of children and the increase of the wages of the working man. Children of very tender years were employed in the factories; they were in the power of the parents who sent them out to work to eke out miserab e earnings, weakening the vital powers of the children and depriving them of educational opportunities.

Child labour competed with the workman and kept wages below the normal. The first Factory Act was passed in the year 1802, and since that time various other acts have been passed.

Trade Boards for Sweated Industries were first adopted in the United Kingdom by the Trade Boards Act of 1909, by which it is provided that a Trade Board can be set up in connexion with any industry by Provisional Order of the Board of Trade (to be

confirmed by Parliament), if the Board of Trade are satisfied that the rate of wages prevailing in any branch of trade is exceptionally low as compared with other employments and that the other circumstances of the trade are such as to render the application of this Act to the trade expedient.

Under the provisions of this Act a District Minimum Wage was applied to four industries in the year 1913, namely, Tailoring, Paper Box Making, Chain Making and Lace Finishing.

An attempt has been made to enforce a National Minimum Wage by Act of Parliament, but this has not been adopted.

The arguments in favour of a National Minimum as set out in the motion which was proposed on the 26th April, 1911, and again on the 9th April, 1913, were as follows :

" That the right of every family of the country to an income sufficient to enable it to maintain its members in decency and comfort should be recognised, and this House is therefore of opinion that a general minimum wage of 30s. per week for every adult worker should be established by law, and also declares that the Government should set an example by adopting this standard in its own workshops.'

Minimum Wage Fallacies

The sentiment of the proposal is undoubtedly in the interest of humanity, but such a proposal must be considered not only from the sentimental but from the national point of view.

The opponents to the proposal claim that it is impossible to establish a satisfactory wage system on an equal basis because of the varied conditions in different districts. What would be a sufficient minimum in industrial centres would be a princely allowance in country districts. It has also been stated that judged from the statistics in the Board of Trade the application of a minimum of 30s. for adult workers would involve an annual charge of eighty-eight million pounds.

A minimum district wage was first introduced into the Coal Mining Industries in 1912, and it is stated that the result is a tendency : (*a*) To depress the higher grade wages towards the minimum. (*b*) To dispense with the labour of the ageing and infirm or the inefficient worker.

If these experiences can be accepted and the census of production taken as a reliable index it would appear that the National Minimum Wage is economically unsound ; while a few might benefit, the majority would suffer.

The co-operative movement is essentially a working class movement and embodies two aims : to improve the lot of the workers by substituting manufactories directed by workers themselves for the factory system in which industry is controlled by the capitalist and the employer ; to enable the worker to spend his wages to the best advantage. This is effected by the establishment of co-operative stores both wholesale and retail.

The movement was remarkable for the simplicity of its inception. In November, 1843, the Rochdale Equitable Pioneers, a body of 28 original members, began operations. The capital was raised by weekly subscriptions of 2d. which was subsequently increased to 3d. When the society had secured 40 members and a sum of £28 they began business at Rochdale, the shop being opened on the December 21, 1844.

Industrial Unrest

From the example of the initial attempt, the co-operative movement, apart from the original society, has spread its ramifications, and to-day, in addition to retail stores supplying the needs of customers, there are wholesale stores, productive industries, factories both at home and abroad, agricultural societies for the production and distribution of produce, and co-operative societies for the building, owning and letting of houses.

Industrial Unrest centres round the distribution of wealth, and the settlement of this great problem without resorting to measures which would at the same time dry up the sources of wealth, would be of the greatest advantage to the community. The co-operative movement has done something but it has not gone far enough, nor can the great manufacturing enterprises of the country be taken over in that way.

A closer relationship between capital and labour would go far in the right direction. How can this then be brought about ?

Attempts have been made in isolated cases by adopting profit-sharing and in other instances co-partnership.

Co-partnership emanates from and necessarily includes profit-sharing.

The underlying principle is that the worker receives in addition to his wages a share of the profits which must however be fixed at the commencement, or at any rate before the end of the financial period to which the profits relate. The extension of profit-sharing called co-partnership requires that the worker shall purchase out of these profits shares in the business in which he is employed. J. W. U.

PHILOSOPHY.—XIII

ONE of the foremost champions of Idealism was the celebrated Bishop Berkeley (1685–1753), whose views are eloquently and clearly expressed in the "Treatise concerning the Principles of Human Knowledge" and in "Three Dialogues between Hylas and Philonous."

According to this thinker, neither primary nor secondary qualities have any *locus standi* in the realm of objective existence; their being consists solely in their being perceived —*esse est percipi*. All objects of sense exist only as ideas of the mind, and all knowledge is that of our own states of consciousness.

The Idealist's Standpoint

Objects and ideas being identical, it followed that objects could not exist without a mind to perceive them; and the difficulty of explaining the persistence of objects when they are not being perceived was surmounted by affirming that they always exist in the mind of God.

The following passage gives the gist of the Berkeleyan epistemology: "That neither our thoughts, nor passions, nor the ideas formed by our imagination, exist without the mind, is what everybody will allow; and to me it is no less evident that the various sensations or ideas imprinted on the sense, however blended or combined together (that is, whatever objects they compose), cannot exist otherwise than in a mind perceiving them. . . . The table I write on, I say, exists—i.e., I see it and feel it, and if I were out of my study I should say it existed, meaning thereby that if I were in my study I might perceive it, or that some other spirit actually does perceive it. As to what is said about the existence of unthinking things, without any relation to their being perceived, that is to me perfectly unintelligible. Their *esse* is *percipi*; nor is it possible they should have any existence out of the minds or thinking things which perceive them."

Although we may agree that the knowledge of our own mental states is the most certain, and that the qualities of objects reside in our minds, yet we feel it is going too far to assert that the only being an object has is "in a mind." There seems to be a fallacy in the use of the phrase "in a mind." When I see a horse, the horse is not *in* my mind, although the thought, the idea, or the concept of it is. There is nothing to disprove the claim that there is something apart from my own mentality which corresponds to, if it is not identical with, my concept, or which gives rise to it (see *Problems of Philosophy*, pp. 60–66). The existence of "something" extra-mental seems to be a necessary postulate or assumption not only for everyday life, but also for the pursuit of philosophical inquiry.

From the circumstance that we can only know things and events in the manner in which they present themselves to our minds, many thinkers like to indulge in the speculation as to what and how these things and events are "in themselves." Such conjectural elements of thought are called "things in themselves," things *per se*, or "noumena." The last term is the preferable, because the word "thing" inevitably evokes the idea of a solid object, and we have seen that solidity is a sense datum. The word "phenomena" is used to connote "happenings" or events as they appear to us; "noumena" are the same "happenings" as they really are in themselves.

Setting aside the metaphysical and unknowable noumenon, we have resolved the objects of common sense into mental states and an unknown extra-mental something. We shall now inquire how the world is pictured by Physical Science, and what becomes of it when it is subjected to analysis.

Science versus Common Sense

The common-sense world may best be termed a "construct," something built up by the mind from the data presented to it in sensation. The world of physics is no less a "construct," but the picture is a different one. Physics, like common sense, started with the belief in the actual existence of rigid bodies, permanent in time and continuous in space, but with growing experience it realised that all objects are not rigid, e.g., gases, vapours, smoke, clouds; and that many of them, at least, continually undergo change. Whilst common sense contented itself with registering the facts of sense-experience, physics tried to get beneath them and, aided by the advances made in dynamics, it postulated the existence of something which was permanent and rigid in a sub-sensible world.

If the objects of sense were not permanent or rigid, then they must be composed of very minute, invisible, indestructible particles which were called atoms; and just as a block of salt on being pulverised splits up into fragments of the same shape which retain all the properties of salt, so the particles partook of the nature of the objects except in that they were rigid, permanent, and discontinuous. Not only did this hypothesis

of " concealed masses " permeate the science of dynamics, but it proved capable of accounting for numberless facts, old and new, in the sciences of physics and chemistry; for example, the indestructibility of matter became more intelligible on the assumption that it was composed of indestructible atoms.

But phenomena could not be described adequately in terms of moving matter alone; the motion of matter visible and invisible must have a cause or propelling agent. This cause was called " force." The idea of it probably originated in the muscular sense of man, but it was found necessary to *hypostasize* it, i.e. to give it an objective existence, to " read it into " the external world.

Force and Motion

Force produces motion, and motion is indestructible—so when, for example, a railway engine strikes a buffer, its motion is not destroyed but is communicated to the invisible particles which compose them both. The latest phase in the development of this sub-sensible world is that the particles are not material but composed of smaller particles—the so-called electrons.

Although the notions of a void and of action at a distance have never presented themselves as obstacles to common sense, the man of science has never liked them. Accordingly, when matter was rendered discontinuous by the hypothesis of atoms, it was thought expedient to fill up the blank spaces between the particles (and even to permeate them) with a new continuity called the " ether," a remarkable entity which possessed some of the so-called properties of matter, but not all.

The ether not only fills the interstices between the atoms or electrons, but by virtue of its movements serves as the vehicle of heat and light and other natural " forces " or forms of energy.

Leibnitz has elaborated the doctrine that force, an immaterial principle, is the real essence of things. Body being an extension of materiality, the essence of that materiality, according to Leibnitz, is the immaterial and indestructible principle of force.

Berkeley indeed goes much further than Leibnitz; although the latter admitted that things have an objective existence, the 'good" Bishop does not admit the existence of unseen or unseeing things. For example, the common objects of the earth and sky would cease to be if none were present to see them; without the mind nothing exists.

Nor was the entity force all-sufficing; there were many different kinds of changes, and each kind was said to be due to a particular force—cohesion, gravitation, chemical affinity, surface tension, etc. From this plurality of forces there gradually emerged the unity called " energy," of which force is only one manifestation, and which in recent times has been promoted by some to the first and only place in the hierarchy of reality, ousting both matter and mind. Moreover, with its aid a whole multitude of phenomena can be explained or correlated.

It must not be thought that these denizens of the sub-sensible world are mere useless fictions, or vain poetic imaginings; they serve very useful ends; they enable us to view apparently diverse phenomena from a single point of view; they serve to " organise " the data of consciousness, and some of them have proved immensely fertile in promoting discoveries. But are we on these accounts to credit them with objective, real existence?

We trow not. The very perusal of this necessarily very sketchy description of the world of physics leaves the conviction that we are not yet at the end of the story: that hypotheses or " views " come and go, although in many cases residual elements of an effete one are incorporated in its successor. " The thoughts of men are widened with the process of the suns," and we seem to have no more justification for thinking that electrons, ether, and energy are the final words of physical science, than we have of regarding the aeroplane of to-day as the final development of aerial transport. A science progresses by changing its points of view.

Thus we learn that the physical view of the external world is very different from that of common sense. It is probably nearer the truth.

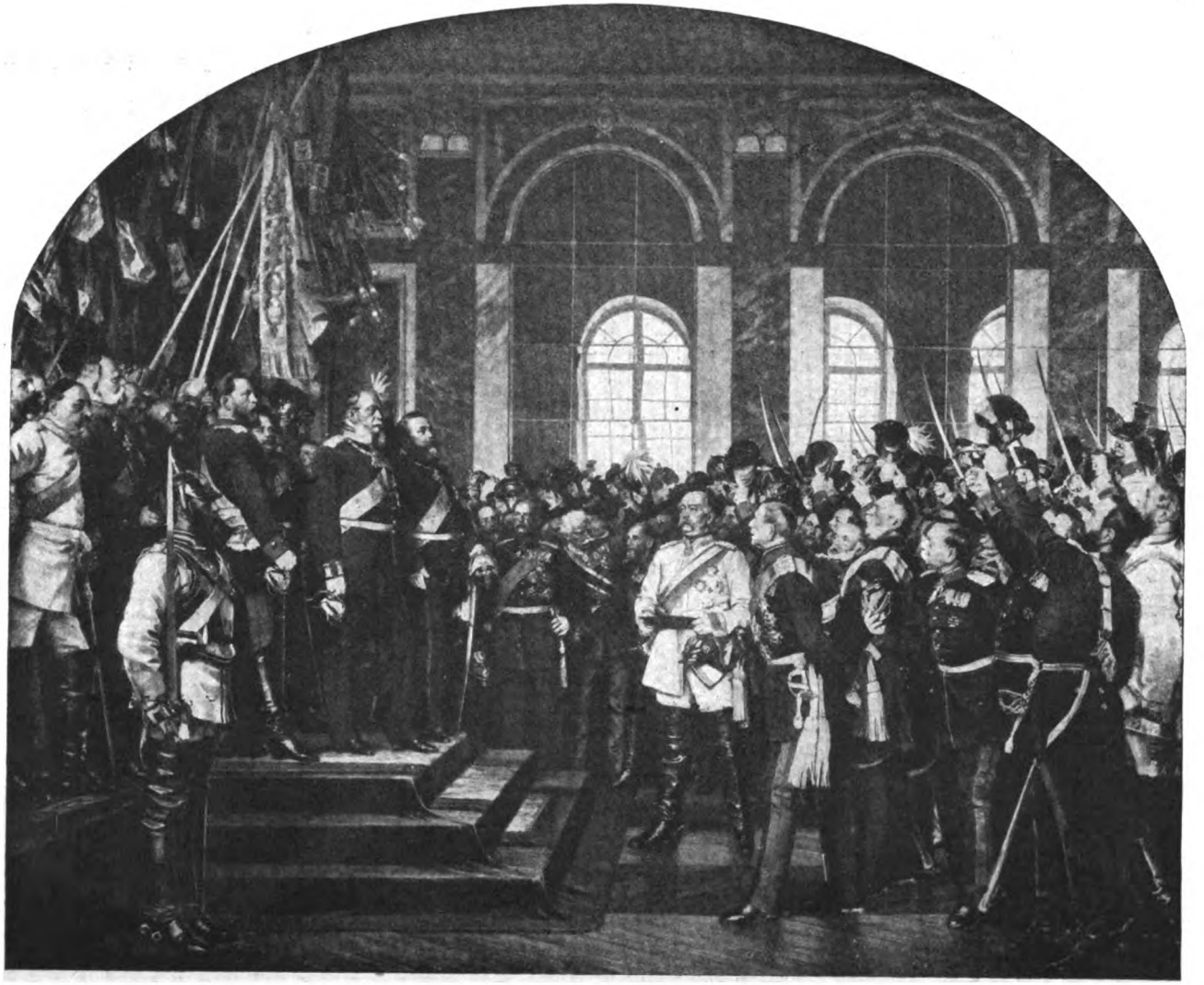
Summary

The " good " Bishop Berkeley stands out as an historical champion of the claims of Idealism. All the knowledge we possess is that of our own states of consciousness. Objects are identical with " ideas," and nothing exists except what is " in a mind."

The metaphysical " things-in-themselves " or " noumena " are believed by some to exist as a substratum of material objects or phenomena. If they exist, they must be for ever unknowable.

The common-sense (realistic) view of the extramental world is a " construct," a mental tapestry woven with the threads of knowledge supplied primarily by sensation.

The scientific view of this world is very different from that of common sense, but it is also a " construct." Whether correct or not, it has a high pragmatic value. E. H. T.



KING WILLIAM I. OF PRUSSIA PROCLAIMED EMPEROR OF GERMANY

in the Galerie des Glaces at Versailles on January 18, 1871. Bismarck is seen reading the proclamation, with the famous General von Moltke at his side.

Continued from page 198.

HISTORY:

***Contributors:*—J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.**

THE RISE OF PRUSSIA.—II

PRUSSIA survived the heavy blows which Napoleon inflicted, thanks largely to the statesmanship and sagacity of Stein.

Aware that fighting was out of the question for some time to come, he set himself to quicken the self-respect and self-confidence of the nation, supported in all he did by the patriotic Queen, Louisa of Mecklenburg-Strelitz. He instituted administrative and political reforms, such as the abolition of serfdom, free trade in land, equality of classes before the law, universal conscription, promotion in the State service by merit alone, besides various municipal reforms.

Stein and Scharnhorst

Hardenberg, another distinguished statesman, established peasant proprietary and developed his colleague's enlightened schemes of social betterment. Scharnhorst, the third man of the hour, introduced short-service into the military system, drafting the soldiers as fast as they were trained into the reserve and enrolling fresh recruits, abolished degrading punishments, and improved the *moral*. Napoleon now intervened. He intended to dispatch into Spain every available man excepting a small force needed to secure him from insurrection, and insisted that the different measures of reform should be dropped. In vain Stein urged the King to fight rather than comply. Frederick William, at Napoleon's order, dismissed the statesman. But the French menace had alarmed the Tsar, and he retired from the Continental System. Napoleon then knew he must fight Russia or go under.

In return for a guarantee of the integrity of the kingdom as it now stood and the prospect of some increase, Napoleon secured a free passage for his army through Prussia. But Napoleon's invasion of Russia went awry, and its colossal collapse revived the spirits of the Prussians and stimulated their zeal for deliverance. Their king, however, still temporised, and the favourable moment might have been missed, had not General Yorck, in command of the Prussian contingent in the French army, negotiated the Convention of Tauroggen, in Kovno (December 30, 1812), agreeing to withdraw his troops from further fighting. In his terror Frederick William cancelled the Convention and dismissed Yorck, but popular feeling ran dead against him. Stein, whom the Tsar had commissioned to administer East Prussia, at once convened a Diet at Königsberg, which decided to call out the whole nation in arms. The king bent before the storm, and concluded the Treaty of Kalisch (1813), which bound him to furnish Alexander I. with 80,000 men.

The War of Liberation

A wave of enthusiasm swept over the land and the War of Liberation began. The Allies were beaten, but not dismayed, at Lützen and Bautzen, and, being joined presently by Austria, their hopes of victory ran high. After several engagements, in which fortune inclined now to one side now to the other, the "Battle of the Nations" at Leipzig (October 16–18, 1813) compelled the French to evacuate Germany.

Next year Napoleon abdicated at Fontainebleau, and at the Congress of Vienna Prussia received Lower Saxony, Cleves, Berg, Jülich, the electoral areas of Cologne and Trier, with the city of Aachen, parts of Luxemburg, Limburg, Swedish Pomerania, Posen and Thorn. She ceded to Russia the grand-duchy of Warsaw, to Bavaria Ansbach and Bayreuth, to Denmark Lauenburg, and to Hanover East Friesland, Hildesheim, etc. While these readjustments were in progress Napoleon fled from Elba (March 1, 1815). The Allies lost no time in crushing him. The Prussians, under Blücher, were obliged to retreat at Ligny (June 16), but while

Napoleon was engaged with Wellington at Waterloo (June 18), they turned up in time to enable the British to take the offensive and themselves to help finish off the Emperor by a vigorous pursuit.

Though Prussia had partially rehabilitated herself in her own eyes, despite the King's lack of character, she missed the chance of the leadership of Germany by his one-sided policy after the peace. He had, indeed, signed the Holy Alliance (September 26, 1815) in which Russia, Austria and Prussia intimated their intention of governing in accordance with the teachings of Christianity, but from which the Pope and the Sultan were excluded; yet the constitution promised to Frederick William's subjects was never produced, although the common sense of his statesmen and their honesty of purpose averted any popular outbreaks.

Economic Reorganisation

It was, in truth, due to the complete reorganisation of her economic and social condition which was achieved in the generation following the downfall of Napoleon that the Liberal movements which affected most of the Continental States left Prussia comparatively untouched. Trade by land, sea and river derived a great impetus from numerous commercial treaties; the country was opened up by the construction of admirable roads; a comprehensive system of national education was established.

Everything seemed to be done for Prussia, and done well and willingly—in fact, the country soon began to suffer from the effects of over-government and the evils of bureaucracy—save the boon of civil and political liberty. But the King obstinately viewed all projects of reform in these fields as akin to revolution, and would have none of them. His death, in 1840, transferred his responsibilities to his son, who was by no means fitted to bear them.

Frederick William IV. (1840–58), to a remarkable degree, reproduced the good and bad points of his father. A patron of literature and the fine arts, he was infirm of purpose and had no faith in the people. He sanctioned a few trifling improvements, but every promise of more adequate reform was evaded. But he was a firm upholder of German unity, provided the leadership were entrusted to him. The revolutionary agitation of 1848 found ready response in most of the German States, which were disposed to establish a federal empire, with Prussia at the top, though democrats and visionaries aimed at a republic. The Prussian king proved a stumbling-block alike to Moderates and Radicals, and it was only after a collision between his soldiers and the people, and the rearing of barricades in the streets of Berlin, that he ordered hostilities to cease.

His brother William, Prince of Prussia, who was regarded as "the villain of the piece," sought refuge for a time in England. The King took the Liberal movement under his own wing, and proclaimed his wish to be the "leader of a free and new-born German nation" (March 21, 1848). At that moment trouble arose with Denmark over the duchies of Schleswig and Holstein, both of which were largely German. The Danish King pronounced his kingdom to be one and indivisible, and his son, Frederick VII., who succeeded in January, 1848, promulgated a Liberal constitution. But, encouraged by the success of the revolutionary movement elsewhere, the Germans in the two duchies claimed to be admitted to the German Bund.

Schleswig and Holstein

The King of Prussia sent an army to help the duchies, but the troops were recalled before the dispute had reached a fatal point, because it was alleged that Britain and Russia were disposed to support Denmark. Hostilities were resumed later, and, in the end, Austria and Prussia were compelled to restore peace in the duchies. By the Treaty of London (1852) the integrity of Denmark was guaranteed, the rights of Holstein in the Bund were safeguarded, and Schleswig continued Danish.

Meanwhile (1848) a constituent assembly had met in Berlin and feeling rapidly rose to fever heat. The King at last took decisive steps. A state of siege was proclaimed in Berlin. The assembly, which had been transferred to Brandenburg, was dissolved a few weeks later, and the ministry issued a fresh constitution establishing two Chambers elected by indirect vote. Throughout this crisis a national assembly had been in session at Frankfort-on-Main. Though attended by many able men, whose intentions were beyond challenge, it followed largely the precedent of the French Assembly of 1789 and wasted valuable time in "talking at large." It committed more than a tactical blunder in electing the Archduke John of Austria provisional administrator of the empire in preference to the King of Prussia, then personally unpopular. Endless discussion arose over the questions of fundamental rights, the constitution, and the relations of Austria to the federation. When a decision was at length reached, and it was

resolved to offer (April 3, 1849) the empire to Frederick William IV., the proposal was shorn of much of its attractiveness, and Frederick William refused it.

The Diet then determined to offer the leadership temporarily to the next most powerful prince, and to require the various States to adopt the constitution. To encourage the recalcitrant, terrorism was resorted to, and riots broke out in towns and cities; but without the backing of armed forces these risings were insensate follies and easily suppressed, and on June 18, 1849, the first German Parliament closed its doors. The Prussian King, however, always a believer in a united Germany, still hankered after a federation, with Austria excluded, and, in 1850, another Parliament was summoned at Erfurt. But it was attended only by some of the northern States, and its influence was discounted when Austria daringly restored the effete Bundestag at Frankfort.

These rival houses divided Germany into opposite camps and provoked a good deal of ridicule. Within Prussia itself, too, a party, led, among others, by Bismarck, was bent upon preventing their kingdom from losing its individuality by premature attempts after unity—which could only be lasting if it were voluntarily adopted—and advocated the repudiation of revolutionary projects and ideas and an alliance with Austria and Russia. So long as the rivalry of Austria and Prussia were unimpaired, the Tsar did not mind; but Frederick William IV. would not forsake the quasi-Liberal constitution he had granted in 1850, and elected to bide his time for the leadership of Germany. In 1857, however, he developed symptoms of insanity; next year his brother and heir, William, assumed the Regency, and in 1861 the weak-minded, ineffective King passed away.

THE FRENCH MINISTRY WHICH DECLARED WAR

against Prussia in 1870. The Emperor Napoleon III. is seated in the middle of the group with Ollivier, the Prime Minister, on his left, and de Grammont, the Foreign Minister, on his right.

William I. (1861–88), the second son of Frederick William III., was a soldier by profession, and a born absolutist. Long before he came to the throne he had avowed a heart-whole antipathy to Liberalism in every shape and form. When he put the crown on his head at Königsberg, he declared that he "ruled by the grace of God and of no one else," and told the Chamber of Deputies that he could never suffer any question of internal progress to endanger the rights of the Crown and the power of Prussia. He could not see that such personal rule was entirely at variance with the spirit of the age and was likely to become the fruitful source of friction. Neither time nor occasion

was well chosen for these sentiments. The domestic economy of the kingdom had reached a remarkable standard of excellence, and the people whose intelligence and industry had raised it to this eminence might reasonably expect a full measure of civil and political freedom. But the King was dogged in his obstinacy and dissolved the Chamber. The next Chamber was more Liberal and equally refractory, and was in turn dissolved, and William then announced he should do his duty to his people without regard to "these pieces of paper called constitutions."

He summoned (1862) to his counsels Herr von (afterwards Prince) Bismarck, a Junker of Junkers, who even outstripped his master in autocracy, and who was the King's guide and mainstay until the end.

Bismarck's Aims

A *coup d'état* on the one hand, or a revolution on the other, seemed certain, when Bismarck cunningly turned to his own and the King's account the strong sympathy evinced by the Bund with the Danish duchies, whose relations to the Crown were reopened on the accession of Christian IX., whose daughter Alexandra had just married the Prince of Wales, afterwards Edward VII.

Bismarck took the lead in asserting the rights of the Germans of Holstein and Schleswig, and Austria had no alternative but to acquiesce. The duchies were occupied, some fighting ensued, but the combatants were too unevenly matched for continued warfare, and the Danish King ceded the duchies without terms (1864). By the Convention of Gastein (1865) Prussia undertook to administer Schleswig, Austria Holstein, and Lauenburg was sold to the former for two and a half million Danish thalers. Prussia occupied Kiel, and began to fortify it forthwith.

Bismarck had attained his end: Prussia had led and Austria had followed, and he took good care this order should never be reversed. Rivalry between the two Powers for German hegemony had now grown acute, and war loomed in the near future. Not only did popular sentiment prefer a German head State like Prussia to a mixed Power like Austria, composed of Germans, Magyars and Slavs, but Bismarck had cynically averred that German troubles were better settled by "blood and iron" than by making speeches and passing resolutions. This meant that, in the present instance, at any rate, he was quite ready for action, as was proved by the issue. For the whole campaign against Austria lasted only seven weeks. Prussia carried everything before her, and after the crowning victory at Königgrätz, or Sadowa (July 3, 1866), Austria consented to the Treaty of Prague.

Prussia obtained Hanover, Hesse Cassel, Schleswig-Holstein, Nassau, and Frankfort; Italy, which had made a secret treaty with Prussia, secured Venetia; Austria withdrew from the Bund and, though losing no territory, was to pay an indemnity of forty million thalers; and the South German States surrendered either specified territories, or paid indemnities, or did both. Bismarck next proceeded to form the North German Confederation for the States north of the Main The Prussian King was to be hereditary President-General, aided by a Federal Council (Bundesrat) presided over by a Chancellor appointed by Prussia; and legislation was entrusted to a Reichstag, the deputies to which should be elected by direct vote Conscription on the Prussian model was to be adopted, every male over 17 years of age serving. Bismarck was chosen as the first Chancellor.

By means of the Zollverein Prussia was connected, on the mercantile side, with the South German States, and while the territories of Bavaria, Würtemberg and Baden were guaranteed, these States were required by treaty to place their armies at the disposal of Prussia in the event of war. Saxony, having narrowly escaped absorption for its share in the Austro-Prussian war, could only accept Hobson's choice.

Birth of the Empire

It was, indeed, plain that all Germany, barring the Germans under Austrian rule, was virtually under Prussian headship. Bismarck now saw his way to convert this headship into actual sovereignty, and this was why he refrained from inflicting extreme penalties on Austria's confederates in the recent conflict. He desired that the South German States should seek incorporation with the Empire, to all appearance of their own accord. He had but to revive the historic dread of trouble from France and to make the initiative of wrong come from the French and the thing was done.

Quite unwittingly Napoleon III. played Bismarck's game. The provisional government of Spain offered (July 4, 1870) the throne, vacant since 1868, to Prince Leopold of Hohenzollern. He was willing to accept it, but, as a Prussian subject, had first to obtain his King's consent, which was given. Napoleon, who could see in the affair nothing but a scheme of Bismarck's to extend

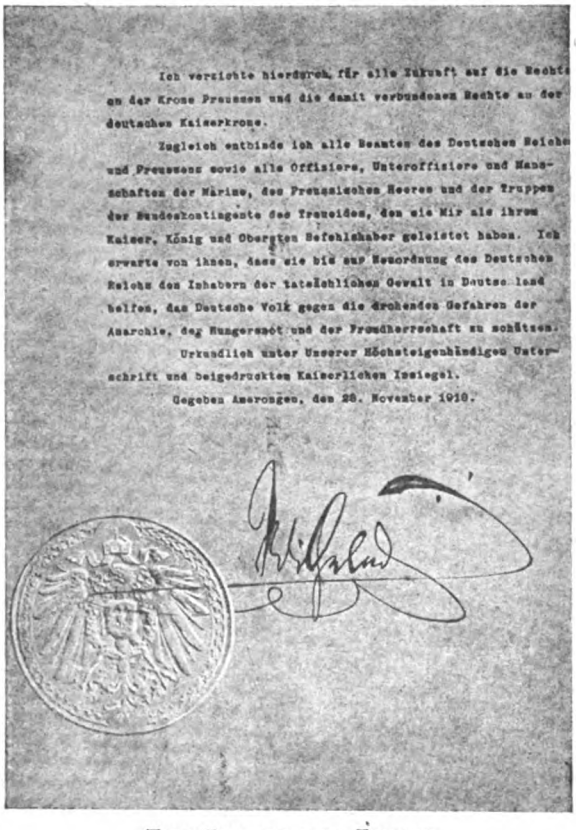
From the painting by Anton von Werner. By permission of the Berlin Photographic Co.

Bismarck riding to meet the Emperor Napoleon III., who, in the early hours of September 2, 1870, after the disaster at Sedan, set out in a shabby open carriage to surrender himself to the victorious Prussians.

From the painting by W. Camphausen.

After the meeting, the carriage, at the Emperor's request, was halted outside a weaver's cottage, where, later in the morning, Napoleon and Bismarck (who, it will be noted, in the meanwhile had changed his uniform and donned a helmet) had a long conference, before the fallen Emperor proceeded to the Prussian King's headquarters.

Prussian influence into the Peninsula, lodged a protest, and the Prince at once withdrew his candidature. The Emperor, however, under the fatal delusion that a war would strengthen his waning hold on France, and that, in any case, the South German States would sulk and keep out of it, demanded an assurance that the candidature would not



Ich verzichte hierdurch für alle Zukunft auf die Rechte an der Krone Preussen und die damit verbundenen Rechte an der deutschen Kaiserkrone.

Zugleich entbinde ich alle Beamten des Deutschen Reichs und Preussens sowie alle Offiziere, Unteroffiziere und Mannschaften der Marine, des Preussischen Heeres und der Truppen der Bundeskontingente des Treueides, den sie Mir als ihrem Kaiser, König und Obersten Befehlshaber geleistet haben. Ich erwarte von ihnen, dass sie bis zur Neuordnung des Deutschen Reichs den Inhabern der tatsächlichen Gewalt im Deutschen Land helfen, das Deutsche Volk gegen die drohenden Gefahren der Anarchie, der Hungersnot und der Fremdherrschaft zu schützen.

Urkundlich unter Unserer Höchsteigenhändigen Unterschrift und beigedrucktem Kaiserlichen Insiegel.

Gegeben Amerongen, den 28. November 1918.

THE END OF THE EMPIRE

which Bismarck had laboured to build. The typewritten document, signed at Amerongen on November 28, 1918, by which William II. renounced for ever his right to the Prussian and to the Imperial German Crowns.

be renewed. Naturally King William declined to do any such thing. Thereupon France declared war against Prussia.

The North German Confederation immediately placed its whole forces at the service of Prussia and voted a sum of 120 million thalers; the South German States hastened to fulfil their treaty obligations, and an army of 440,000 well-trained, well-equipped, and well-officered men took the field. Napoleon was in no such fortunate condition, and, save as regards personal bravery, his soldiers were no match for the Germans. From Saarbrück (August 2-3, 1870) to Sedan (September 1) was but a month, yet on September 2 Napoleon was a prisoner, and on September 4 the French Republic was proclaimed. Nothing could stay the German advance, and Paris, after a siege heroically borne, surrendered on January 29, 1871.

As the facts of the war had falsified the word "North" in the title of the German Confederation, towards the close of the previous year the Southern States entered the Bund, and the Main ceased to be a dividing line. The finishing touch to the edifice of which the Great Elector and Frederick the Great had laid the foundations, and to which Prince Bismarck added the copestone, was applied in the Hall of Mirrors in the Palace of Versailles, on January 18, 1871, when William I., King of Prussia —having been invited to assume the Imperial Crown a few days before by the King of Bavaria and other sovereign princes—was proclaimed German Emperor.

The Awakening

Had Bismarck been a statesman of the highest genius and sincerest intention, however, he would have unified Germany by including within the bounds of the new empire all the German race which could reasonably be incorporated. His prime and essential aim was far otherwise. He sought to promote the aggrandisement of Prussia, and, rather than jeopardise this object, left some twelve millions of Germans who were of, but not in, the Fatherland to the dim and uncertain future of the Dual Monarchy.

If we ask why he chose to pursue this course the answer is, that he would not see Berlin subordinated to Vienna as the capital of the restored Germany. The Prussianisation of Germany, which inevitably ensued, is the most striking fact in her history since 1871. Thus a new war of liberation may be needed, not to deliver Germany from the outer foe, but to break the iron bonds of Prussia.

The Hohenzollern power in Prussia—a power which had made Prussia dominant within the German Empire—brought about its downfall, and with it appeared all the elements of reaction and revolution in their crudest aspects. Bismarck's dream of a united and strong Germany, based upon the dominion of the most aggressive partner, had failed. J. A. M.

Continued from page 215.

SCIENCES:

Contributors:—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).

BOTANY.—XXIV

75. Adaptation to Environment. — So far we have considered the plant as an individual; but of course the growth and development of any plant is in many ways conditioned by its *environment*, by which term we mean all the various factors in its surroundings that have an influence upon it; and it is an exceedingly interesting branch of our subject to consider the various ways in which plants have become fitted to their extremely diverse habitats.

Under the head of environment we have to include—(1) the soil, and its special characteristics; (2) light, water, air, and other similar factors; (3) animals and plants.

(1) We have already studied the nature of the soil, and noticed how certain plants show special likings for particular kinds of soil. For example, on chalky soil, the beech and the ash are the most frequent trees, whereas on lighter soils the oak and the birch predominate over them. Similarly such shrubs as the clematis, wayfaring-tree, and dogwood show a predilection for chalk, as do many herbs, such as the dyer's greenweed, bladder campion, rock rose, and many others. Again, many plants prefer a very damp soil (*hydrophytes*), while others (*xerophytes*) flourish only in dry, loose soils. In all cases of this kind there are to be discovered special, and sometimes striking, adaptations to the peculiarities of the conditions.

(2) The importance of light has been insisted upon in previous lessons; but there are wide differences between plants which grow in shady woods and those which grow on a sunny bank. The woodland plant does not flourish in the sunny situation; it is adapted to the shade and cannot face the full light. The water-supply, too, may be fresh or saline, acid or alkaline, and the plant has to adapt itself to this also. And again, an exposed situation produces adaptations to the wind which are useless in sheltered places. A comparison between the flora on the north and south sides of a hedge will show the influence of light and of cold winds. On the north side, mosses, lichens, and very stunted plants often form the only vegetation; facing the sun we might find such plants as coltsfoot, stitchwort, red-campion, herb-robert, dead-nettle, etc. And if a tall hedgerow with a ditch at its base is examined, the effect of the light and of the water-supply can at once be seen. The dry, upper parts of the hedgerow may be almost bare, or contain a few tall slender weeds and climbing plants, while from the lower parts of the hedge come such strenuous species as the nettles, woundworts, red-campions, willow-herbs, figwort, etc. A few plants such as hedge mustard, hedge garlic, hedge parsley, goosegrass, herb-robert, stork's bill, etc., thrive very well in a dry, sunny hedgerow. Such idiosyncrasies the student can only discover by careful observation from year to year.

(3) In general, plants do not grow singly, but either in colonies of their like or in association with other plants. This introduces an element of competition which modifies profoundly the structure of many plants. Individuals can, of course, respond to changes in the environment only to a

limited degree ; but species have developed along favourable lines which have given them advantages over their competitors, so that they have held their own. Grasses which grow in dry situations tend to have rolled or circular leaves ; those which grow in shady woods have broader and flattened leaves, because light is scanty. Plants which thrive in a cornfield must either grow up to the level of the corn, or be humble little weeds content with little light and the superficial layer of the soil. Hence we find there tall stalwart plants like poppy and corncockle and tiny weeds like field madder and corn spurrey. In their different ways these plants hold their own in competition with the corn. Animals, too, enter into the matter. Caterpillars like leaves, birds like seeds, and browsing animals would devour many plants if they were not protected by spines or thorns, by stinging hairs, by bitter or poisonous liquids, or by other means. In many ways, plants have developed their protections ; Nature has eliminated the unprotected specimens, and the best (from the plant's point of view) have survived.

Fig. 188.—Foxglove, Campion, and Hogweed—typical of the tall plants which grow near the edges of woods, where good soil and light make for rich growth.

76. Woodlands.—In studying the flora of the woods we shall have to consider first the shrubby undergrowth and then the ground flora. When the wood is a dense one, say of beech or pine, both these strata are scanty or absent entirely. In some pine woods we find nothing but lichens and small mosses—the light is too feeble at all times to support the higher plants. The beech woods on our chalk downs do not exclude vegetation so completely, but only in the early spring are conditions really favourable, i.e. before the canopy of leaves has appeared. Thus we find in such woods chiefly early plants with underground food-stores. Dog's mercury, wood anemone, lesser celandine, wood spurge, bluebell (*Scilla nutans*), primrose, belong to this category. Later the plants are small, with comparatively large leaves and often highly scented flowers, sometimes parasites or semi-parasites. Wood sorrel, moschatel, wood sanicle, various orchids, woodruff, enchanter's nightshade, and wood sage are among the common woodland flowers of early summer. In the more open birch-woods, a more liberal flora is available, including such species as the yellow archangel, bugle, betony, yellow pimpernel, and others. The soil is rich in humus, and often very light in texture, which is favourable for the growth of thick rhizomes. When the wood is damp we find, among other species, herb Paris, marsh violet, bog-pimpernel, and the spotted orchis. Among the shrubs there is considerable variety and density, dependent on the light facilities ; honeysuckle, guelder-rose, sallow, hazel, bitter-sweet, as well as brambles, form the staple undergrowth of a typical ash-wood, not far from London. Near the edges of woods it is common to find tall, strong plants flourishing, such as foxglove, mullein, purple loosestrife, red campion, agrimony, hogweed, etc. ; a combination of good soil and abundant light accounts for such a rich growth.

77. Meadows and Cornfields.—In a meadow the chief competitor is the grass which grows tall and also tends to occupy the soil completely. Hence meadow-plants generally grow up with the grasses, their leaves insinuating themselves among them and their roots diving below those of the grasses and thus drawing on a different layer of soil. Dandelions, daisies, and plantains compete in rather a different way. Their leaves, by throwing those of the neighbouring

Photos: Henry Irving.

MARSH AND SEASIDE PLANTS.

(1) Yellow Iris; (2) Water-mint. These are typical of the abundant flora of the marsh, which, receiving the drainage of surrounding hills, is rich beyond the average in the soluble constituents of the soil. (3) Sea Holly, which thrives on sand dunes, out of reach of the tide.

grasses into the shade, kill them, and thus enable the intruder to occupy the ground instead. The flowers, too, must be conspicuous on the dark background, and therefore have long stalks. If the soil is scanty, and the grass consequently stunted, as it is often on chalk downs or in exposed situations, a more specialised flora comes into evidence: including such plants as milkwort, bladder campion, salad burnet, bee-orchis, self-heal, marjoram, eyebright, rest-harrow, milk vetch, hawkweeds, nipplewort, etc.

In cornfields the conditions are different. The soil is probably good and well-prepared; it is well adapted for the rapid growth of comparatively small plants, with an efficient arrangement for seed-dispersal. Most of the characteristic cornfield-species are annual weeds. Examples are shepherd's purse, scarlet pimpernel, charlock, chickweed, groundsel, mayweed, corn spurrey, goosefoot, knotgrass, corn buttercup, shepherd's needle, fumitory; the last-named three have finely-divided leaves, in association with their situation.

78. Moorland and Heath.—These two situations differ widely in their soil-conditions, but have developed a curiously similar kind of vegetation, adapted to exposed and dry conditions. The typical moorland is to be found among the bleak hills, and heather and gorse are the dominant vegetation, as they are on the sandy commons which constitute the typical heath. It is in the subsidiary flora that they differ.

The heath has a scanty soil, mainly through excessive drainage, and the small leaves are at least as much an adaptation to the deficient water-supply as to the exposed conditions overhead. A true heath has thus a very scanty vegetation. Sometimes, we find broom as well as gorse; beneath the heather, we find harebell, tormentil, heath bedstraw, grasses with slender leaves and tufted roots, as well as bracken in wide patches.

The soil of a moorland is generally of a peaty nature—sometimes dry and sometimes boggy. The peat is composed of the dead and compacted remains of mosses, heather, etc., with more or less soil intermingled with it. On this basis grow the heather, heaths, whortleberry, crowberry, bog-myrtle, together with sedges, rushes, and narrow-leaved grasses. In the boggy portions we find cotton sedge over large areas, and (more isolated) lesser spearwort (*Ranunculus flammula*), gipsywort, grass of Parnassus, bog-asphodel, sundew, butterwort, marsh cinquefoil, buckbean, as well as the sphagnum or bog-moss everywhere. The xerophytic characteristics of many of these plants are probably due to the acidity of the water in the bog, owing to the excess of humus and the deficient aeration. A few of them, such as the whortleberry, probably like the humus as such.

79. Marsh-Plants.—Marsh land is the low-lying land near the borders of ponds and streams, and is often quite different from bog-land where the water is stagnant and often involved among spongy mosses. The marsh receives the drainage from the surrounding hills, and is consequently rich beyond the average in the soluble constituents of the soil. A marsh flora is therefore often abundant, consisting of large well-nourished plants, which have a liberal water-supply at all times. Grasses, sedges, and rushes grow large and coarse; and among other typical marsh-plants are the marsh marigold, marsh figwort, marsh mallow, willow-herbs, brooklime, forget-me-not, iris, ragged robin, loosestrife, lousewort, dropwort, hemlock, water-parsnip, water-mint; and, where the marsh has a tendency to be peaty, spearwort, purslane, blinks, Claytonia, marsh cinquefoil, pennywort, etc., are found.

Some of these plants grow partly submerged in the water. These are especially the tall and narrow-leaved forms—sedges, reeds, rushes, mare's tail, etc. Commonly the bulrush is the most tolerant of water among these, and few of the marsh-plants follow it. Passing beyond the habitat of the reeds and rushes we reach the water-plants proper. Some of these fix their roots in the bottom of the water; among the floating forms are duckweed, frogbit, and bladderwort.

The true water-plant generally has two kinds of leaves: those on the surface are generally large and roughly circular, with their petioles near the centre; while the submerged leaves are finely dissected. The latter condition has two obvious advantages: the plant is not so easily carried away by currents of water, and nevertheless the leaf exposes a greater surface to the action of the water. Such leaves are dependent upon the carbon dioxide and oxygen dissolved in the water for their gas-supply. The former is abundant enough, but the latter is deficient, and as there are no stomates the plant has a difficulty in getting it from the water, the larger floating leaves have many stomates on the upper side, and a waxy cuticle to protect them against the action of the water. Moreover the internal tissue of the plant is rich in air-spaces, and corre-

spondingly poor in the unnecessary strengthening tissues. All these points can be well studied in the common water crowfoot. Other water-plants are the pondweeds, the Canadian pondweed, the white and yellow water-lilies, water milfoil, and water starwort.

80. The Seaside.—Plants which grow by the sea have had to adapt themselves to the excessive presence of salt in the water and also to cold and violent winds. The leaves of the characteristic seaside flora are generally fleshy or skinny for the retention of water or for the reduction of transpiration, so that too much of the salt water need not be absorbed. On a rocky sea-cliff we find samphire, sea thrift, scurvy grass, fairly commonly; but on the sandy part of the coast, especially on the sand-dunes out of reach of the tide, we find another kind of vegetation. Here we come across sea-holly, sea campion, sea milkwort, orache, sea spurge, sand sedges, the coarse Marram-grass—mostly perennials with long creeping rhizomes and dry leathery leaves. Further inland are to be found such plants as stonecrop, ragwort, rest-harrow, bird's foot trefoil, stork's bill, heather, and gorse—all with small, fleshy or hairy leaves, and more or less xerophytic habit. A few annuals in-

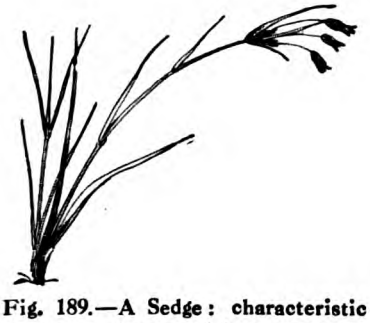


Fig. 189.—A Sedge: characteristic of marsh plants which grow partly submerged.

habit these sandhills, but the conditions—especially the seasonal water-supply—do not encourage them.

In enclosed inlets of the sea, salt marshes are formed by the mud and silt washed in by the tide. They are often very extensive in a tidal estuary, and ultimately become colonised by a limited but characteristic flora, which approaches more nearly to that of the neighbouring sand-dunes, as the amount of silt increases. The first colonists are small seaweeds, after which comes the curious Marsh Samphire, or Glasswort, with (in some places) the grass-wrack (*Zostera*). As we approach the sandy shore we meet with the sea lavender, sea milkwort, sea thrift, and the coarse grasses of sandy soils. All these plants are fleshy as a result of the saline environment.

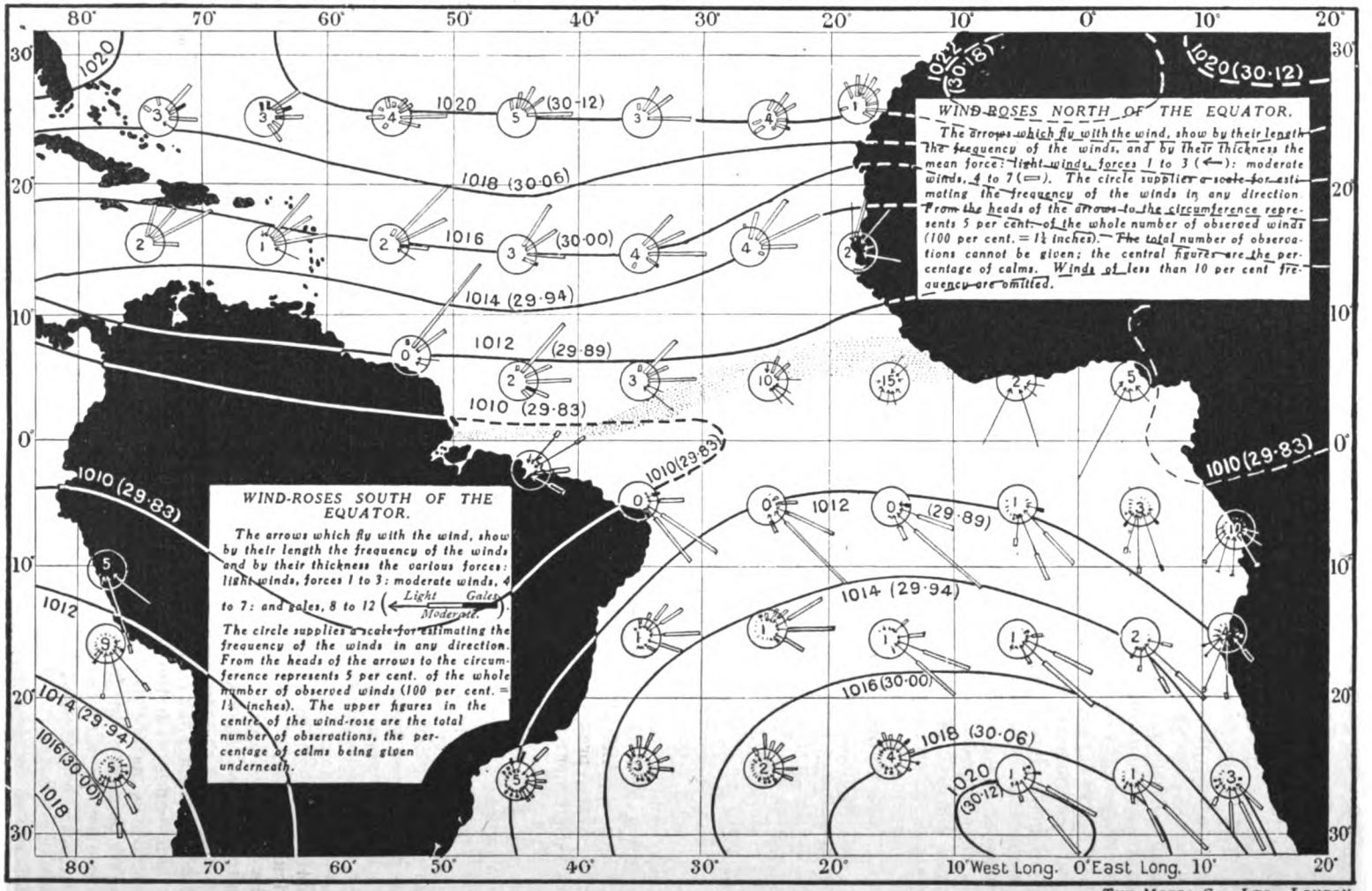
81. Waste Land.—A rubbish-tip, a railway bank, a newly-opened quarry or a little-used roadway, illustrates the kind of habitat where only the hardy and pushful species have a chance. When the ground is hard or rocky, the first colonisers are lichens or mosses, and it is long before there is sufficient

Fig. 190.—Samphire, a native of sea-cliffs.

humus to support a higher flora. The soil on a mountain summit or a rugged sea-cliff, scanty as it is, has taken many centuries to form. Where the soil is loose, however, the first visitors to take root are annuals with an efficient method of seed-dispersal, which already flourish somewhere near by. Before a year is out, perennials begin to take root and gradually monopolise the whole of the soil. The necessity of strong wide-spreading roots in such soils is enforced by the scanty amount of humus and by their general lightness. As an example of the kind of plants found, the following list comes from a made soil on the outskirts of a town, in the second year of its formation; little or no organic matter was included in the "tip": four species of grass, groundsel, shepherd's purse, field speedwell, fool's parsley (abundant), dead nettle (white and red), yellow archangel, knotgrass, creeping buttercup, silverweed, dandelion, thistles, nipplewort, knapweed, purple loosestrife, charlock, white campion, plantain, dock, fumitory, milkwort. Temporarily unused land, even in the heart of cities, often may be seen brilliant with the rich colour of the purple loosestrife. Rather different conditions prevail in an open heath which has been burnt: for a long time the chief vegetation is the revival of the bracken, gorse, or heather whose roots have not been destroyed.

E. W. E.

WIND CHART OF THE INTERTROPICAL BELT OF THE ATLANTIC OCEAN — DECEMBER.



THE MAPPA CO., LTD., LONDON

In the area represented by the map it will be noted that nearly all the winds come from the north-east or the south-east—that is to say, the map shows the distribution of trade winds.

METEOROLOGY.—VI

THERE are several recognised ways of representing the direction and force of winds on maps. In most of the simple weather charts issued in the daily press small arrows are used. The direction of the arrow corresponds to that of the wind, and the velocity of the wind is roughly indicated by the number of "feathers," and to some extent by the pointed end of the arrow. Thus, a very light breeze is indicated by an arrow without "feathers," and only one line at the side of the arrow head, whereas gales are indicated by several "feathers" in addition to a completely finished arrow tip. But a far more useful and comprehensive representation of wind features consists of the use of diagrams known as *wind roses*.

Wind Roses

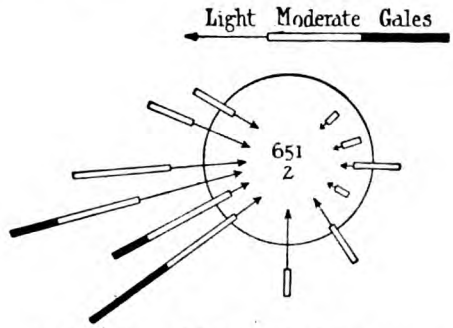
In the Meteorological Office type, the length of an arrow represents the frequency of the wind, and the thickness gives some indication of the velocity and force. A map of a large area such as the North Atlantic Ocean, is divided into rectangular spaces, and the wind rose placed in each space supplies information of the frequency, direction, and velocities of any winds that have blown in the corresponding area during the month of which the map is a record.

In the area represented by the map it will be seen that nearly all of the winds come either from the north-east or from the south-east, and that the wind roses have no arrows indicating westerly winds; in other words, the map shows the distribution of what are called the trade winds. It should be noted that gales are indicated by thick black portions of the arrows. A navigator who wishes to know the kind and frequency of winds prevalent over a certain portion of the ocean during a certain month or period has only to consult the wind rose map of that particular month.

The ordinary and usually accepted explanation of the circulation of air in the lower portion of the atmosphere has already been discussed in Vol. II., pp. 225–227, where the trade winds with the intervening calm region known as the Doldrums, and monsoons are described, but for the meteorologist the problem of air circulation presents a much more complicated study in mathematics.

One or two of these considerations must claim some attention. It has already been stated that winds are due to differences in pressure, and while this is generally true, *in some cases the speed and force of winds are out of proportion to the pressure difference*, so that some other cause such as convection must contribute to the result.

The whole question of atmospheric circulation is one of great difficulty, and it may be as well if we merely accept a very broad classification of winds according to their more obvious origins. Thus, some winds are certainly due mainly to convection (*see* Heat, Vol. I., p. 341), and of these, it is usual to distinguish ascending currents of heated



A Wind Rose (M.O. type). The top number in the centre refers to the number of observations made; the lower figure (2) indicates the percentage of calms.

air, or *Anabatic* winds, from descending streams of cold air called *Katabatic* winds.

Wind Types

These convection winds are generally land winds, and the good examples occur in mountainous regions where cold descending, or Katabatic winds flow down valleys and hill slopes, the speed ever increasing as a consequence of accumulation of cold air higher in the valley forcing that lower down the valley along at a higher speed. Katabatic winds may be likened to waterfalls; air pours down in a kind of gaseous cascade. Well-known winds of this type occur in the south of Europe, the Balkan States and Adriatic region, for instance, and, of course, the Monsoons are of this class. The greater number of winds, however, are those in which the velocity is proportional to difference in pressure; in other words, the *pressure difference is balanced by the velocity*. Such winds are termed *Strophic winds*.

Of these, there are two well-marked types. Both types, however, consist of spirally moving or circular winds revolving around inner areas of lower barometric pressure, but their origins are considered to be quite

different. The two types are known as *Cyclostrophic* and *Geostrophic* respectively. The Cyclostrophic varieties embrace winds that rapidly revolve around relatively *small* low pressure areas, i.e. areas generally a few miles in diameter. These winds revolve around the low pressure area in much the same way as water revolves around the outlet pipe of a bath when the water is running out. The velocity is often terrific, and is due to the exceedingly low barometric pressure in the centre of the whirlwind.

The whirling winds and their accompanying low pressure area move along a definite pathway (*see* the diagram on p. 269), and at a rate frequently about 30 miles per hour. It is the general arrangement that travels with that speed, whereas the revolving winds themselves move with a velocity often 100 miles per hour. These Cyclostrophic winds occur mostly in regions situated near the two tropics; hence they are known as *Tropical Revolving Storms*. In different regions they are known by different names, such as typhoons of the China Sea, hurricanes in the West Indies, tornadoes in N. America, and cyclones of the Indian Ocean. The term Cyclone is thus used in two ways, one to represent these whirling storms, but more often to designate a much larger low pressure area with slower spiral winds of a geostrophic nature.

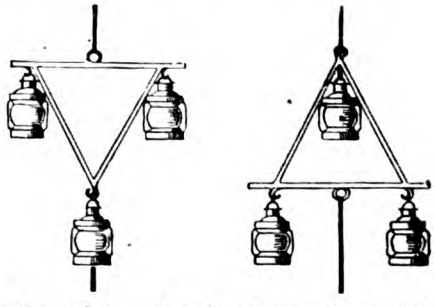
Day Storm Signals. A cone hoisted with cone pointing downwards indicates gales from S., W., S.W., or S.E.; with cone pointing upwards, from N., N.E., N.W., or E.

On account of the big difference in pressure in tornadoes such winds do enormous damage. The zone of serious destruction is usually some small fraction of a mile in width, and when buildings and other things become involved in this low pressure centre, the air in such buildings suddenly expands, blowing the roof clean off and the wall outwards. The case is similar to the blowing outwards of windows due to the explosion of bombs causing a temporary vacuum by an uprush of air from the spot where the bomb fell.

These tropical revolving storms move northwards or southwards away from the equator along directions depending on the latitude, but their origin is not clearly understood even at the present time. Their frequency is in any particular region, fortunately, not very great. For instance, in the West Indies there were 355 in 300 years, and in the China Sea 214 occurred in 85 years. An interesting feature in connexion with such whirling storms is the formation of water spouts and whirling sand columns. In the case of the water spouts black clouds descend into the funnel-shaped hollow of the low pressure area and water ascends into this funnel because of the low pressure. The column of water moves forward and may carry large quantities of fish on to the neighbouring land.

On land the formation of a dust or sand column is very similar, the dust or sand being caught up in the partial vacuum and carried along in the path of the storm. The much dreaded Sirocco of the Sahara is a whirling sand storm of this kind.

A *cloud burst* occurs in the following manner. The central column of a revolving storm being of very low pressure, there is a strong uprush of air, and this uprush for some time balances the weight of condensing water higher in the funnel-shaped space. There comes a time, however, when the weight of water becomes too great for the uprushing column of air, and it descends literally in torrents as if poured from a reservoir. When this occurs the cloud is said to burst. The torrential descent of water produced in this way sometimes digs deep hollows in the ground.



Night Storm Signals are identical with those used by day, save that the cone is represented by a triangle bearing lights at its angles.

Revolving storms are the most serious item the mariner has to consider, conse-

quently special advice concerning them is given in the Barometer Manual quoted in an earlier lesson.

Since the inner area of very low pressure is frequently only a fraction of a mile in width, timely observation may enable a ship to alter her course so as to pass to the side of the storm. The majority of winds that we are familiar with belong to the *Geostrophic* class, and are due to the rotation of the earth itself. The earth carries air with it as it rotates on its own axis, and if there were no convection effects or other factors to cause air to circulate from one latitude to another the result would be a calm. But all parts of the earth's surface do not rotate at the same speed; and owing to convection or other disturbances masses of air having a certain speed move to places in other latitudes where the speed is either greater or less than that of the air when it commenced to move.

The results are westerly and easterly winds. Geostrophic winds move in slightly curved lines around *large* inner areas of different pressure, and the speed of such winds is very much smaller than that of the whirling Cyclostrophic wind. We may regard the production of the winds we usually encounter as being due to a combination of convection and the results of the earth's rotation. In order to grasp the salient feature of the distribution of Geostrophic winds the reader should again refer to the illustration in Geography, Vol. II., p. 227.

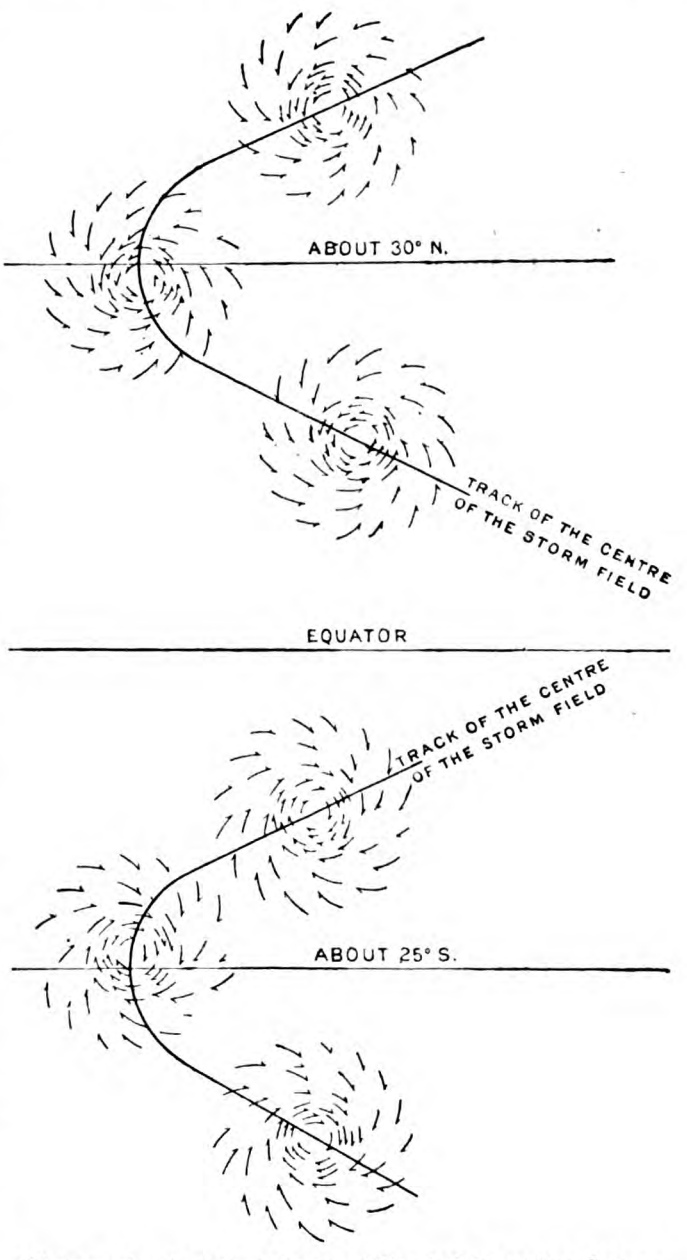


Diagram showing the pathway of Tropical Revolving Storms, North and South of the Equator.

A valuable function of the Meteorological Office is the issue of storm warnings to localities which are likely to experience a gale within a few hours after the receipt of the warning. There is quite a large number of signal stations situated around the British coasts, particularly on the western side, since most of our gales blow from that direction.

On the receipt of a warning, the station hoists a black canvas cone three feet high and three feet across, measured at the widest part.

If the apex of this cone points downwards, the sign indicates that gales may be expected from the south, west, south-west, or south-east. The cone so hoisted is known as the *south cone*. Gales expected from the north, north-east, north-west, or east, are indicated by the *north cone*, i.e. the cone suspended with the apex pointing upwards.

At night time the cone is represented by triangles bearing lights at the corners, as shown in the illustration. The warnings hold good until eight o'clock on the evening of the day following that on which the telegram was sent, and should the storm be likely to continue beyond that time, an order to keep the cone in position is sent from the Meteorological Office. A gale often " veers " or alters in direction, and it should be remembered that a southerly gale veers to a point farther west, whereas easterly gales usually change towards the north. The east coast benefits most by these storm warnings, since the greater proportion of our gales blow from the west, hence sufficient time is obtained to give adequate warnings to harbours, etc., on the east.

Storm Warnings

This is true for larger regions than the British Isles, since the Continent obtains valuable forecasts from our islands which are situated in a westerly disturbed area. Although atmospheric electricity has been described elsewhere (*see* Electricity), one or two words concerning the subject may not be out of place here.

The mode of collection of electricity in the atmosphere is not fully understood, but it appears to be favoured by a high temperature. The most frequent and violent thunderstorms occur within the tropics, and usually at the hottest part of the afternoon. At some tropical parts, such as the neighbourhood of Rio de Janeiro in Brazil, these storms are of almost daily occurrence. Even in our own latitudes thunderstorms occur chiefly on hot sultry days of summer, winds are practically absent before the storm, and rain generally falls during and after the storm. The electricity accumulates on raindrops and dust motes so that a fall of rain dissipates the electricity. Many a heavy shower may have prevented things coming to a climax in the form of lightning and thunder. The amateur who desires to try his hand at lightning photography should sit in a dark room with the camera shutter open and the focus such that a clear image of distant lights is obtained on the screen. Sometimes electricity of the atmosphere dissipates itself in the form of a silent discharge appearing as a glow on masts of ships, lightning conductors, etc., and to this phenomenon the name of *St. Elmo's Fire* has been given. Other silent discharges connected in some way with the earth's magnetism are the Auroræ observed in Arctic and Antarctic regions. L. M. P.

ZOOLOGY.—XXXIII

THE industry of the Bee upon a fine day is so obvious that it has become proverbial. Everybody knows that its consistent coming and going between the flowers and the hive is concerned with the collection of honey and pollen, which is carried, the honey in the first stomach, and the pollen upon the bristles of the broadened thighs of the hind legs. But the most remarkable facts in the life of these industrious workers are undoubtedly those which occur within the hive.

In every great occurrence vitally affecting the interests of the community, the bees are governed by hard and inflexible laws. How these laws come into being, and who decides the precise moment at which they are to be brought into operation are questions concerning which no answer is forthcoming. All that is certain is that at such moments the bees display remarkable unity of purpose and singleness of aim. In normal circumstances but one Queen is to be found within the limits of the hive.

Bee Laws

But when the bees have increased to such an extent that the migration of some of their numbers has become necessary, we should expect that a younger Queen still lying in nymph-like form in its cell would be reared to lead them. This, however, is not the case ; the law of procedure is immutable, and upon the appointed day, usually between 10 o'clock in the morning and 3 o'clock in the afternoon, the reigning sovereign voluntarily abdicates her throne and sets out to found a new kingdom elsewhere.

Shortly after the late Queen has taken her departure, the first of the royal nymphs issues from her cell and commences a direct attack upon her royal sisters. A situation has now arisen in which the bees display an almost uncanny sagacity, for whether the Queen is allowed to carry her murderous work to a conclusion or is prevented from so doing by the Workers, depends entirely upon the number of bees that has been left in the hive after the departure of the last swarm. If in the opinion of the inhabitants the city is still too densely populated, the angry Queen is thrust back and the safety of the royal cells is guaranteed by a living barrier. In such a case the new Queen soon imitates the example of the late monarch and leaves the hive escorted by another section of its population. But when a

second swarm is inadvisable no attempt is made to frustrate the intentions of the new Queen, who rapidly kills the undeveloped nymphs.

The bees, however, are so far human that at times a hitch occurs in their plans and two Queens make a simultaneous appearance. The danger of civil war would in such circumstances appear to threaten the community. But here again the bees display uncommon sagacity, for the fighting is entirely limited to the two parties chiefly interested. The attitude of the Worker may be defined as "Settle the matter between you, but settle it quickly and finally, for peace is essential to us all." The Queens, then, are left to fight it out; nor is this all, for should they shirk the combat, as they sometimes do, the bees coax them back to renewed attacks until at length one falls a victim to the deadly sting of the other.

Functions of the Drone

After the nuptial flight of the Queen, to which reference has already been made, the hive is once again the scene of a brief but poignant drama. In the internal economy of the hive there is no room for the useless. Queen and Worker are alike bound by clearly defined duties, but the Drones have played their brief part and henceforth, were they allowed to live, could only be a drain upon the resources of the community. This fact the Workers appear thoroughly to understand, and one day, as though at the call of some preconcerted signal, they rise in their thousands and hurl themselves upon these great handsome and useless Males.

For some strange reason the Drone is destitute of the sting with which every Worker is armed. He is more powerful than the attackers, but less dangerous. Outnumbered and without any adequate weapon of defence he fights bravely but hopelessly. Many go down at the first rush. Others gorged with honey are incapable of attempting escape and await impotently the execution of the sentence that has been pronounced against them. Still others are dragged, the centre of a struggling mass, to the alighting board where they are suffered to go. Their fate, however, is scarcely more enviable than that of their slaughtered comrades, for they do not know how to obtain sustenance from flowers, and they dare no more to return to their own hive than to enter a strange one. In short, they inevitably succumb to their hard lot.

Like other rich industrious communities the hive is sometimes subjected to attack. This is often the case when the inmates of another hive with which all has not gone well take to bad habits and commence to raid the wealthier and better-managed communities round about them. Against such robbers the sentries at the gate are usually a sufficient safeguard, but the individual bee is often a sufferer at their hands. Returning home laden with honey it is waylaid by the robber, who holds it up in the most approved fashion. Inserting his proboscis well into the stomach of his victim, the robber extracts the honey at his ease, and only permits the hard-working bee to depart when he has, so to speak, thoroughly gone through his pockets.

Enemies of the Bee

Or it may happen that some plundering snail, attracted possibly by the scent of honey, will find his way into the hive. It might be imagined that such an enemy, by reason of his trusty shell, would form an awkward antagonist, but the bees have an ingenious method of dealing with such a situation. Briefly, they surround the stranger in great numbers, and secrete a resinous substance known as *propolis*, which effectually glues the snail to the floor. Propolis has other useful qualities; it dries very rapidly and is used by the bees to cover any foreign body which on decomposing might affect the hive.

A far more dangerous invasion is that of the Death's Head Moth. In a manner which has never been satisfactorily explained these insects succeed both in passing the sentries at the gate and in eluding the attacks of the agitated bees within. It has been suggested by several writers that the cry of the Death's Head Moth so closely resembles that of the Queen Bee that the Workers are thrown into a state of great confusion, and are debarred by loyalty to their rightful sovereign from punishing the intruder according to his deserts; but be that as it may, the Death's Head Moth as often as not, when once she has entered the hive, makes herself responsible for a great amount of destruction.

Another enemy, whose visit generally means the utter destruction of the hive, is the Honeycomb Moth. This extraordinary creature, braving all dangers, enters and frequently succeeds in laying its eggs before it succumbs to the attacks of the infuriated inmates. When the eggs are hatched, the larva hastily covers itself with a silken

cocoon. Through this guard the sting of the bee is unable to penetrate and, as though appreciating this fact, the larva carries his protection with him in his devastating march.

When one of these creatures has been at work in a hive, it is possible to see this

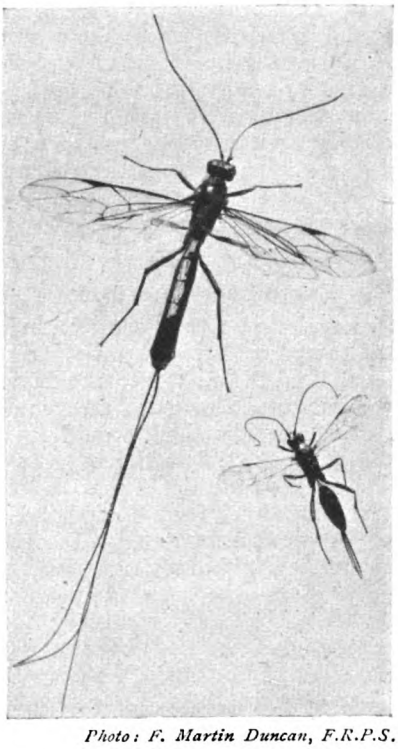


Photo: F. Martin Duncan, F.R.P.S.

ICHNEUMON FLIES

are parasitic in their larval state on the larvæ of moths and butterflies.

tube-like structure winding and twisting in all directions. In this fashion the larva gradually eats its way through one comb after another until the bees, unless man comes to their assistance, perforce abandon the struggle and go elsewhere.

The extent to which the communal life of the bee is based upon conscious effort forms a debatable point. Some writers state that there are bees whose sole duty it is to supervise the efforts of their fellows. Were it proved that this was the case, a strong argument would be provided in favour of the bee's intelligence ; but it is well not to overlook the possibility that these supervisory duties, if they exist, may only form part of the regular routine of the hive, and as such be discharged by all the bees in turn. The point is, of course, of some importance when an attempt is made to distinguish between instinctive and purely intelligent action.

An argument, which seems to count against the possession of any considerable amount of intelligence on the part of the bee, is based upon the simple experiment of confining one of these insects in a bell-shaped glass, the open end of which points directly away from the light. In such circumstances the bee will seldom find its way out. It is thought by many that the bee, by the experience of many generations, has come to associate light with the door of the hive, and that this fact explains its apparent stupidity. But when a bee and a fly are confined together in such circumstances the fly will usually escape very

Photo: F. Martin Duncan, F.R.P.S.

SOLITARY WASPS

construct cells in which they lay their eggs in decayed wood, a disused burrow, or some similar spot.

rapidly. If it is just to attribute the orderly progress of the hive to the possession of reason on the part of the individual bee, it is surely logical to suppose that the insect would be able to draw certain deductions from the escape of the fly, but curiously enough in actual practice it does not appear to do so.

On the other hand most authorities agree that the bees have a language and communicate with each other by means of the antennæ.

No reference to the bee would be complete that did not mention that wonderful instrument, the bee's sting. "Look at the edge of a razor," wrote the Reverend J. G. Wood, "or a needle's point and a bee's sting under the microscope, and then perhaps some idea of its exquisite character may dawn upon the mind. Whilst the razor's edge looks like the back of a stout knife villainously made, too blunt and uneven to cleave a billet of wood; whilst the point of the needle appears to be some quarter of an inch broad and of irregular shape, full of holes and scratches, the sting shows everywhere the most consummate workmanship, ending in a point that even when so highly magnified still appears fine and sharp." But as the writer points out, what is seen is not more than the scabbard of still more delicate instruments which, perhaps, are best described as two-bearded darts. The poison which enters the wound is carried in a reservoir at the base of the sheath.

The Bumble Bee, of which there are about a dozen species in Britain, is a large heavy insect which exists in families rather than societies. The nests are built either in or on the ground. The queen mother collects pollen from flowers; and certain vegetable material from which she is able to concoct the waxy substance employed in cell making. Several eggs are laid in each cell, which is then completely closed. The number of individuals in the nest of the Bumble Bee is very small when compared with the number of bees to be found in the average hive.

In a nest of the *Bombus terrestris*, which is commonly thought to contain the largest number of individuals, have been found thirty-five females, twenty males and one hundred and sixty Workers. The conditions of life amongst these insects are similar in many respects to those of the hive-bee, but are far more simple. It is a sad fact that the hard-working and patient Bumble Bee is frequently imposed upon by a disreputable relative of a genus known as the *Apathus*. This bee, in the absence of the owner, visits the nest of the Bumble Bee and there deposits her eggs, leaving the care of the larvæ to her poor but honest relation.

The Common Wasp is one of six species of the genus *Vespa* found in Britain. Though the social life of the wasp does not approach that of the hive-bee in perfection of organisation, these insects have many traits in common. Each wasp colony consists of

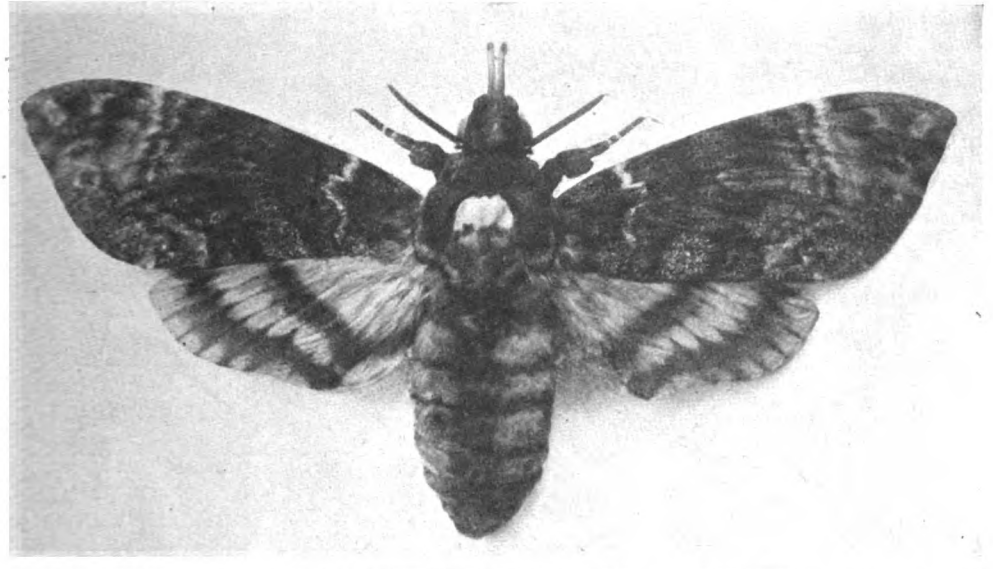


Photo: John J. Ward.

DEATH'S HEAD HAWK MOTH,

the largest British moth, is a deadly enemy of the bee; it can produce a sound like the squeaking of a mouse.

a Queen, a number of Workers and some Drones, and the cells constructed by these insects are similar in general character to, though mathematically less accurate than, those found in the hive. The nest itself is usually built underground, though this rule has many exceptions, the roofs of outhouses sometimes being favoured.

In the Natural History Museum there may be seen a hat in which some wasps constructed a nest whilst it was hanging in an outhouse at Tring. Social Wasps when building a covered nest usually suspend a few cells by a stalk from some satisfactory roof. From these cells a second and longer row is suspended, and this process is continued according to the demands of the community. The nest has an opening at the foot, and is enclosed by an envelope which is extended from time to time to take in additional rows of cells.

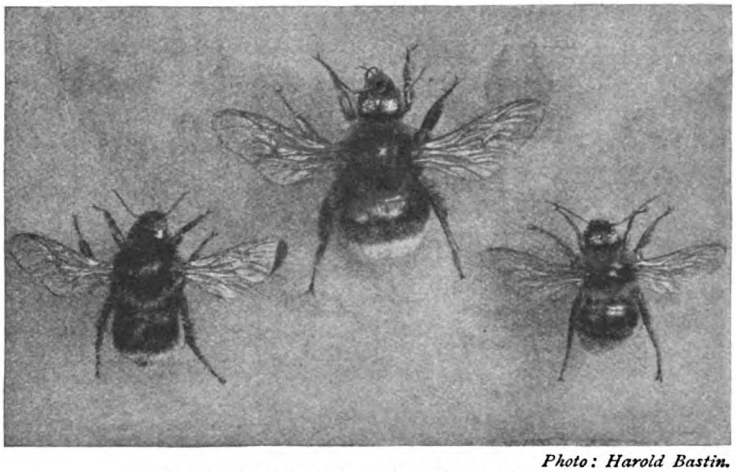


Photo: Harold Bastin.

INMATES OF A BUMBLE-BEES' NEST.

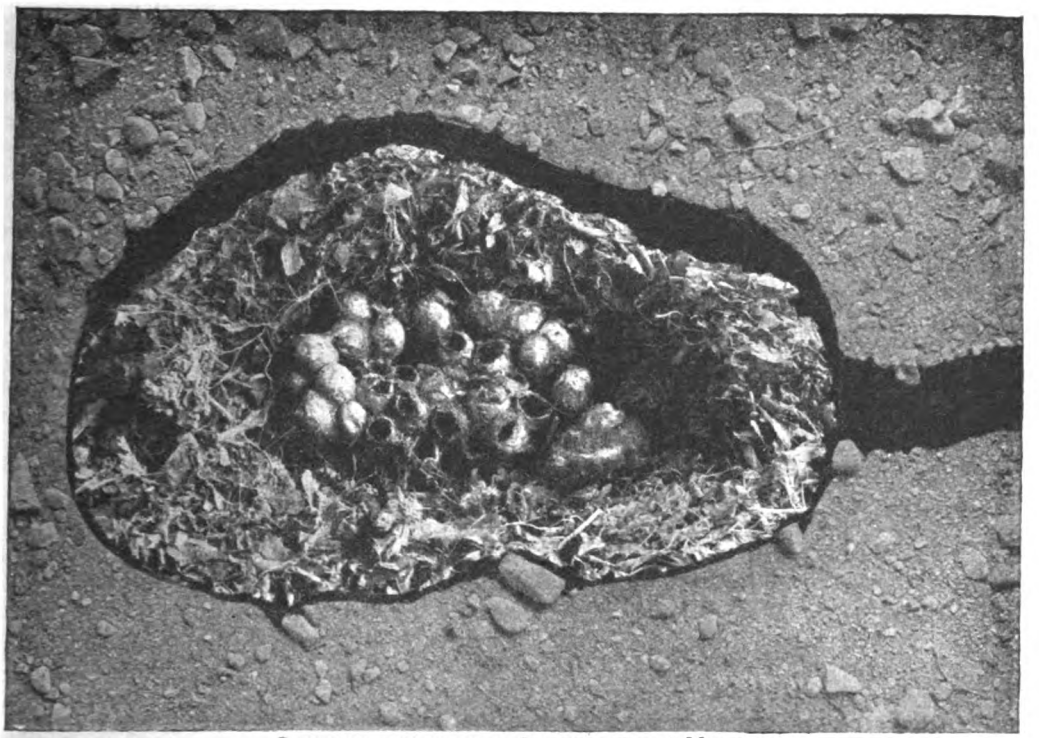
Left: A typical "Worker." Centre: The "Queen." Right: A "Drone," or male.

In other cases a row of cells is attached directly, that is without the medium of the stalk, to a leaf or branch, and is enclosed as in the previous instance. When additional cells are added, they are affixed to the cover of the first row, to which communication is secured by a passage through the comb. The material used for making the combs is manufactured by the wasps from fibres of dry wood, which they chew until they are sufficiently "pulpy" for the purpose.

The Solitary Wasps, like the Solitary Bees, construct cells, in which they lay their eggs, in decayed wood or in a disused burrow or in some similarly suitable spot. These insects are smaller than the true wasps, which in other respects they greatly resemble. The Wall-wasp gathers together numbers of caterpillars after paralysing them with her sting, and upon them lays her eggs. Thus when the larva ultimately makes its appearance it has close at hand a plentiful supply of fresh food. Were the Wall-wasps to kill these caterpillars instead of merely paralysing them they would, of course, decompose before the larva could benefit from their presence.

The Saw Flies (*Tenthredinidæ*) gain their name from the horny saws which are placed side by side on the lower extremity of the abdomen of the females. The eggs of this insect are laid in rows on the ribs of the undersides of leaves. The Gooseberry Saw Fly, which is one of the best-known members of the family, is a common but unwelcomed addition to wild life in the garden. In its larval stage it may be seen crawling amongst gooseberry bushes, a not unhandsome caterpillar of pale-green ornamented with black dots. The family of Gall Flies are dark-coloured insects, extremely small in size. The female Gall Flies deposit their eggs beneath the tissues of plants, causing a swelling or gall in which the larva feeds and grows. More than forty species attack the oak, and amongst the resulting galls is the familiar oak-apple.

The Ichneumon Flies of the family *Ichneumonidæ* chiefly attack the larvæ of butterflies and moths, upon which they are parasitic. In some instances the female Ichneumon pierces the caterpillar's skin and lays her eggs beneath it; in others she places the eggs upon the caterpillar's body, and the larva eats his way into the desired haven. The unwilling host in his caterpillar form furnishes a living repast for his visitor, who contrives to feed upon its fatty tissues without actually killing it. When in a chrysalis state, however, the weakened caterpillar dies, and the Ichneumon larva then issues from within and proceeds to spin its own cocoon. The parasites of the Lepidoptera incidentally tend to check the growth of many insect pests. A. B.



SECTION THROUGH A BUMBLE-BEES' NEST,

showing the entrance tunnel and the packing of vegetable refuse, comb of cocoons, etc.

Photos: Harold Bastin.

COMB OF COCOONS (about natural size),

showing the empty cocoons, from which young Bumble Bees have just emerged. These cocoons are used as honey pots. The presence of the snail shell is quite casual.

ANATOMY AND PHYSIOLOGY.—XVII

THE difference between the human machine and any artificial machine is that the former contains in itself the intelligence and the will-power necessary for its own control.

This control, as we have seen, resides in the nervous system, which consists of a series of arrangements for receiving impressions from outside, for storing those impressions in memory, and for sending out impulses to the muscles to act in accordance with the sensory impressions received. Bound up with all this is the power of adaptation to surroundings, by means of which the body is kept alive to be an efficient machine at all.

The simple reflexes have been studied, and they have been shown to be contractions of muscles as the result of stimulating some sensory surface. Let us carry the same idea further.

The Special Senses

The largest sensory surface we have is the skin, which is covered with nerve endings; but this large surface only carries impressions of things which are actually touching it, and we are aware of our surroundings to a much greater extent than this. We have the power of realising the presence of things which are around us by means of sight and hearing, though the things may be a considerable distance from us. Sight and hearing are two of the *special senses.*

The nerves of the skin itself appreciate at least four different kinds of sensation, namely, touch, pain, heat, and cold. All these are conveyed to the brain by separate means, for diseases exist in which the sensation of pain is lost and that of touch persists, and others in which touch is lost but pain persists, and others again in which the senses of heat and cold are lost but the other two are still present.

The sense of sight is one of the chief means of adaptation to surroundings. Dangers can be seen at great distances, that is, sensory impressions are received through the eyes and optic nerves, and, as a result, the necessary movements can be made to avoid or combat these dangers. There is a close connection between such action and a simple reflex.

The necessaries of life—food and clothing, and the materials required to make them, must, as a rule, be seen before the required movements to obtain them can be made. In nearly all intelligent work, and in the majority of arts, sight is essential.

Sight is an arrangement for the perception of light. The nerves of the skin have the power of perceiving stimuli of touch, or pain, or heat or cold; the optic nerves have the power of perceiving the stimulus of light. If the optic nerve is stimulated in an artificial way, one gets the impression of seeing light; the optic nerve is not capable of perceiving any other kind of sensation.

"What light is" is a matter for students of physics; for our present purpose it is enough to know that certain bodies in Nature, of which the sun is the chief, give out what we call "light," and that our eyes are organs specially made to perceive light.

The Source of Light

Light comes from the sun, or from any other source of light, in "rays." The rays come out straight from the sun in all directions. If you go into a dusty room when the sun is shining, and shut it up, so that there are only a few chinks through which the light comes, you can see the course of a few of the sun's rays. They light up the dust in the air, and you can see a streak of light which gets broader the farther it goes from the chink. A bundle of rays are coming straight from the sun and spreading out as they go away from it.

If you look up at the sun on a clear day, its rays come straight to your eye. They pass through the air, and the air is called "transparent." They will likewise pass through glass, which is also transparent. Light seen in this way is said to be "transmitted."

Light can also reach your eye by "reflection," and the things we see and use in ordinary life are seen as a rule by reflected light.

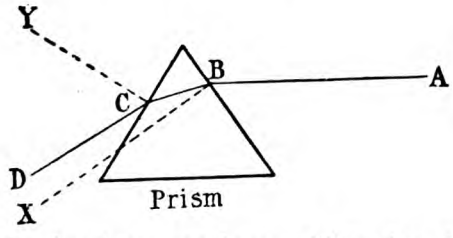
In a normal eye, distant vision is limited by the sensitiveness to light of the retina, and near vision by the power of accommodation, which is usually about five or six inches. It should be noted that the eye only receives the impression, the meaning of which is interpreted by the brain.

Go into a dark room at night. You can see nothing. Now strike a match and hold it up. You can see the walls, the rays from the match fall on the walls and are bent back or reflected to your eye. You can see the top of the table, you can see nothing under the table; it is all dark, because no light from your match falls under the table, and so cannot be reflected to your eye. Everything on which light falls becomes a luminous body by reflection, and reflects rays from the

source of light to your eye. A ray passes from the source of light, falls on some object and is reflected to your eye as a ball could be made to bounce from the wall to your eye.

I am now looking at a house outside my window. The sun is to the right. The roof of this house slopes in such a way that the sun's rays fall on it and are reflected to my eye, so that the roof looks bright. There is a coping at the right-hand edge of the roof, which prevents the sun's rays from reaching the roof just behind it, so that no light comes from there, and I see a line of shadow. The walls of the house are partly in shadow, and so reflect less light to my eye. The walls are white, and reflect most of the light that does reach them, and so appear to be light in colour, but the windows are black, and they absorb the light, and do not reflect it, and so appear to me as dark patches.

This house, then, appears as a pattern of reflecting surfaces, each reflecting a certain amount of light, some less, some more, and each of a certain colour, and as I have seen such things before I know that such a pattern is made by a house. I have the memory of having seen similar things before, and I can compare it with what I see now.



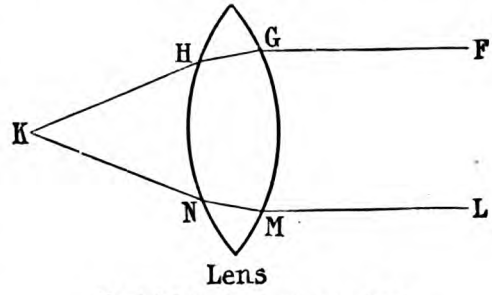
Tracing the course of a ray of light through a prism.

What is the apparatus which brings this pattern of reflecting surfaces, which is a hundred yards away, to my brain so that I can understand it ?

We have seen that rays coming from a source of light spread out, so if they are to be seen by a small organ like the eye, there must be some means of collecting them together. The sun is a very great distance away, and all the rays that enter one's eye at the same time, though they do slightly separate, do it so little, that they may be treated as parallel, and the light coming from this house I am watching may also be regarded as consisting of parallel rays.

Most people have seen a photographic camera, which is a machine made on the principle of the eye. A camera is a box into which light enters through the lens, and is " focused " on a ground glass screen or a sensitive plate. The lens is an arrangement for collecting parallel rays of light and bringing them to one point ; this is called " focusing " the light.

The lens is made of glass, which is transparent ; light will pass through it. But glass is denser than air, and when a ray of light passes from a thinner to a denser " medium," as for instance, when it passes first through the air, and then through water or glass, that ray is bent out of its course.



Explaining the focus of a lens.

This is called " refraction," and it is very important ; it is through this that sight is possible, and on it the use of all magnifying glasses, telescopes, and microscopes depend.

Put a long stick in a tub of water, with one end sticking out towards the right, and look at it from some distance away ; the stick appears to be bent to the left at the point where it enters the water. The light from the left hand end has been " refracted."

When a ray of light passes through the air and falls obliquely on the surface of water or glass, it does not pass straight through it, but is bent towards a line drawn at right angles to the surface of the water or glass ; it is said to be bent *towards the normal.* When light passes through a prism (*see* fig.) a ray of light A B enters the prism at B, and is then bent *towards* the normal B X, and follows the line B C. It leaves the prism at C, and enters the lighter medium again ; it is then bent *away* from the normal C Y, at right angles to that surface of the prism, and follows the line C D.

Now take a lens (*see* fig.). Parallel rays of light F G, L M will be refracted along G H, H K, and M N, N K, and converge on the same spot K, which is the " focus " of the lens.

The eye is a hollow ball, made of a tough membrane, the sclerotic coat, which forms the " white " of the eye. In the front the sclerotic is replaced by the cornea, which is transparent. Behind the cornea is a cir-

cular curtain, the iris, which is coloured, generally either blue or brown or grey. It has a hole in the middle, the pupil, which can be made larger or smaller. Through the pupil the light passes. Behind the iris is the lens, made of clear transparent material. In front of the lens is a fluid called the aqueous humour, and behind it, filling up the greater part of the cavity of the eye, is a jelly, called the vitreous humour.

At the back of the cavity of the eyeball the fibres of the optic nerve spread out and form the retina. On the retina the rays of light coming from the objects we look at are focused, and it is by this means that large objects can be seen by one's small eye. Between the retina and the sclerotic is the "choroid coat," containing blood vessels.

Seeing, Hearing—

The lens is shaped, in a normal eye, in such a way that parallel rays of light—that is, rays coming from a distant object—are focused on the retina. But the rays which come from objects near at hand are not parallel, but divergent, and if these enter the lens of the eye they will not be focused *on* the retina, but at a point behind it, and they will not be clearly seen. But the lens can be *accommodated* so as to see near objects. It is possible to increase the curvature of the lens in such a way that rays from a near object are brought to a focus at the same spot as parallel rays, when they become clearly visible. There are muscles inside the eyeball which make these changes in the shape of the lens.

Another great channel by which we are made aware of our surroundings is that of hearing, and the organ of hearing is the ear. It receives the stimulus of sound, which is due to vibrations of the air. The ear consists of three parts: the external, middle, and internal ear. The external ear is made chiefly of cartilage, covered by skin, and placed at the side of the head; it has a slight function in acting as a funnel and collecting the vibrating air.

The middle ear is a cavity containing apparatus for transmitting the vibrations of the air to the internal ear.

The internal ear is situated inside one of the bones of the skull. The nerve of hearing, the auditory or eighth nerve, is distributed to it, and besides being the organ of hearing it is continuous with another organ, by means of which we are able to tell our position in space. By this is meant the sense by which you can tell in the dark whether you are standing or lying.

If you pass a funnel-shaped instrument called a speculum down the ear you will see at the bottom a membrane, which is the drum of the ear.

The middle ear is a cavity which communicates with the pharynx through a narrow passage called the Eustachian tube. The object of this is to allow air to get into the middle ear. On the inner side of the middle ear is the internal ear. Across the middle ear is a chain of small bones, which are so arranged, that when the drum moves, as it does whenever there is any sound, that movement is communicated by this chain of bones to the internal ear. These bones are called the malleus, incus, and stapes—(the hammer, the anvil, and the stirrup). The hammer is attached to the drum, the stirrup has a "foot-piece," which fits over a hole in the internal ear, and the anvil connects the two. (*See* Sound, Vol. IV., p. 73.)

—Taste and Smell

The internal ear is called the labyrinth. The part concerned with hearing is a spiral tube, called the cochlea, shaped like a snail shell. It is imbedded in one of the bones of the skull called the temporal bone. There are two holes in it, leading into the middle ear: one of them is closed by the stirrup bone, and the other is closed by a membrane.

The cochlea contains fluid. When the drum of the ear vibrates with sound, the small bones of the middle ear are moved, and the stirrup presses on the fluid in the cochlea, which is set moving, and bulges the membrane covering the other opening.

The organ of hearing is inside the cochlea; it consists of cells with hair-like processes, among which the auditory nerve fibres are distributed. As the fluid in the cochlea is set moving, it moves these hair-like processes; this movement stimulates the auditory nerve. The auditory nerve carries these sensations to the brain, where they are interpreted as sounds.

Two other special senses are taste and smell. Taste depends on the stimulation of special nerve endings on the tongue and soft palate. Only four different tastes can be recognised, namely, sweet, bitter, sour, and salt, and to be tasted any substance must be dissolved.

Smell depends on nerve endings in the upper part of the nose, which come from the olfactory bulbs, swellings on the first pair of nerves. In order to be smelt, substances must be in a state of gas. Much of the flavour of one's food really depends on its smell.

D. W. C-J.

Continued from page 162.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A.[Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

GERMAN.—XXXIV

Class 2.—Subordinative Conjunctions.—CLAUSES introduced by these always have the finite verb at the end of the clause. These conjunctions are most conveniently divided according to the kind of dependent clause they introduce.

These clauses are of three kinds, namely, NOUN CLAUSES, which take the place of a noun, ADJECTIVE CLAUSES, which take the place of an adjective, and ADVERBIAL CLAUSES, which take the place of an adverb.

(*a*) Conjunctions which introduce noun clauses: daß, *that*, ob, *whether*, and all those which are connected with the root of the relative pronouns, wie, *how*, warum, *why*, wohin, *whither*, woher, *whence*, and compounds with prepositions such as womit, *with what*, wovon, *of what*. Thus, er weiß, daß es ſchon ſpät iſt, *he knows that it is late already*; Sie ſagten nicht wer er ſei, *you did not say who he is*; er ſchrieb uns wohin wir gehen ſollten, *he wrote to us where* (whither) *we were to go*; wer weiß wovon dies gemacht iſt? *who knows what this is made of?*

(*b*) Conjunctions which introduce adjectival clauses: These are chiefly the relative pronouns der and welcher, and compounds of the simple prepositions with wo to take the place of the cases of the relative pronouns governed by these prepositions; the conjunctions wo, da, als, wie, etc., may also introduce adjectival clauses. Thus, kennen Sie den Mann, der eben hier war? *do you know the man who was here just now?* die Seide wovon dieſes gemacht iſt, iſt nicht gut, *the silk of which this is made is not good*; ich liebe nicht die Art und Weiſe wie er ſpricht, *I do not like the way in which he speaks.*

(*c*) Conjunctions which introduce adverbial clauses may be classified according to the kind of adverbial clause they introduce:

1. Introducing clauses of place, wo and da. Thus, es lag noch dort, wo ich es gelaſſen hatte, *it still lay there where I had left it.*

2. Clauses of time, da, als, wenn, wann, *when*, ehe, bevor, *before*, nachdem, *after*, etc. Thus, er kam erſt, nachdem ich ſchon fort war, *he only came after I had left.*

3. Clauses of manner, wie. Thus, er ſpricht wie ſein Vater, *he talks like his father.*

4. Clauses of cause, weil, da, *as* or *since*, nun, *now that*, etc. Thus, er war ſo ſpät weil er den Zug verſäumt hatte, *he was so late because he had missed the train.*

5. Final clauses, damit, daß, um daß, auf daß, *in order that*. Thus, er arbeitet heute damit er morgen frei ſei, *he works to-day in order that he may be free to-morrow.*

6. Clauses of condition, wenn, *if*, wofern, falls, *in case*. Thus, falls ich ihn heute nicht ſehe, geben Sie ihm bitte dieſen Brief, *in case I do not see him to-day, please give him this letter.*

7. Clauses of concession, obgleich, obſchon, wenngleich, etc., *although*. Thus, obgleich er groß iſt, iſt er nicht kräftig, *although he is big, he is not strong.*

8. Clauses of consequence, daß, *that*. Thus, er lief ſo ſchnell, daß er außer Atem war, *he ran so quickly that he was out of breath.*

9. Clauses of degree or extent, wie, *as*, als, *than*. Thus, er iſt nicht ſo groß wie ſie, *he is not so big as she.*

In addition to these there are a number of conjunctional phrases made up of conjunctions and adverbs such as als ob, *as if*, wenn auch, *even if*, and so on.

The following illustrations of a few of the conjunctions will probably be useful to the student.

The . . . the, in expressions like "the more the merrier," is rendered in German by je . . . je, but in place of the second je we often find deſto. Thus, je länger er ſprach je aufgeregter (or deſto aufgeregter) wurden ſeine Zuhörer, *the longer he spoke the more excited his audience grew.*

Wenn, als, da and wie as conjunctions of time.

Wenn may refer to any time, present, past, or future, and may also be used for an habitual occurrence when it corresponds to

English *whenever*. Thus, wenn ich morgen nach der Stadt gehe, werde ich Trauben kaufen, *when I go to town to-morrow I will buy grapes*; wenn ich lange vorlese werde ich müde, *when I read aloud a long time, I get tired*; früher, wenn ich auf dem Heimwege war, begegnete mir immer ein alter Mann, *formerly when I was on my way home, I always met an old man.*

Als refers to a definite event in the past only, da also refers to a definite event either past or present. Thus, als ich gestern in die Stadt ging, kaufte ich Trauben, *when I went into town yesterday I bought grapes*; als ich ins Zimmer kam, lag er auf dem Sofa, *when I came into the room he lay on the sofa*; früher, da er arm war, war er liebenswürdig, *formerly when he was poor he was amiable*, jetzt, da er reich ist, will er seine alten Freunde nicht sehen, *now when he is rich he will not see his old friends.*

Wie may be used in the same sense as als, but often means as soon as; in the latter case we often find it in conjunction with so. Thus, wie (or sowie) er mich sah, schwieg er, *as soon as he saw me he was silent.*

VOCABULARY

Schießpulver, s.n.1, *gunpowder.*
trüb, *dull, sombre.*
Finsterniß, w.s.f.2, *darkness.*
Mittelalter, s.n.1, *middle ages.*
wahr'nehmen, s., *to perceive.*
Nebel, s.m.1, *fog, mist.*
Thurm, s.m.2, *tower, steeple.*
ein'hüllen, w., *to wrap round.*
Dunst, s.m.2, *mist.*
erklingen, s., *sound.*
verfinstern, w., *darken.*
schwäbisch, *Swabian.*
sich auf'thun, s., *open out, unfold.*
allzu, *too.*
sich erinnern, w., *remember*, gov. gen.
klar, *clear.*
Schmuck, s.m., *ornament, adornment.*
recht, *just* (adv.).
wiewohl, *although.*
Bild, s.n.3, *metaphor.*
preisen, s., *praise, exalt.*
düster, *sombre.*
Kuppe, w.f., *summit.*
Zacke, w.f., *tooth, jagged edge.*
stürmisch, *stormy.*
schroff, *steep.*
Bergkegel, s.m.1, *mountain cone.*
jetzig, *present.*
See, w.m., *lake.*
überströmen, w., *inundate.*
Buchdruckerkunst, s.f.2, *printing.*
bleischwer, *leaden.*
bekanntlich, *as is well known.*
lasten, w., *to weigh.*
wogen, w., *to surge.*
verdecken, w., *cover, hide.*
Gotteshaus, s.n.3, *church, abbey.*
Frühglöcklein, s.n.1, *matins bell.*
Dampf, s.m.2, *steam.*
verständig, *wise, sagacious.*
Thor, w.m., *fool.*
Meer, s.n.2, *sea, ocean.*
Gleichniß, s.n.2, *allegory, metaphor.*
genau, *exactly.*
Dichter, s.m.1, *poet.*
Schnee, s.m., *snow.*
Aehre, w.f., *ear* (of corn).
Aue, w.f., *meadow, fertile plain.*
Antlitz, s.n.2, *face, countenance.*
Fortführung, w.f., *continuation.*
Veranlassung, w.f., *occasion, suggestion.*
Nase, w.f., *nose.*
ragen, w., *tower.*
Klingstein, s.m.2, *clinkstone.*
Denkstein, s.m.2, *monument.*
Vorgeschichte, w.f., *previous history.*
malerisch, *picturesque.*
Niederung, w.f., *low-lying plain.*
Becken, s.m.1, *basin.*
Fluth, w.f., *water.*

Exercise 75

Es war vor beinahe tausend Jahren. Die Welt wußte weder von Schießpulver[1] noch von Buchdruckerkunst.[2]

Ueber dem Hegau[3] lag ein trüber bleischwerer[4] Himmel, doch war von der Finsterniß, die bekanntlich über dem ganzen Mittelalter lastete, im Einzelnen Nichts wahrzunehmen.[5] Vom Bodensee[6] her wogten die Nebel übers Ries[7] und verdeckten Land und Leute. Auch der Thurm vom jungen Gotteshaus[8] Radolfzelle war eingehüllt, aber das Frühglöcklein war lustig durch Dunst und Dampf erklungen, wie das Wort eines verständigen Mannes durch verfinsternden Nebel der Thoren.

Es ist ein schönes Stück deutscher Erde, was dort zwischen Schwarzwald[9] und schwäbischem[10] Meer sich aufthut. Wer's mit einem falschen Gleichniß nicht allzu genau nimmt,[11] mag sich der Worte des Dichters erinnern:

Das Land der Alemannen[12] mit seiner Berge[13] Schnee,
Mit seinem blauen Auge, dem klaren Bodensee:
Mit seinen gelben Haaren,[14] dem Aehrenschmuck der Auen,
Recht wie ein deutsches Antlitz ist solches Land zu schauen,

— wiewohl die Fortführung dieses Bildes Veranlassung werden könnte, die Hegauer[15] Berge als die Nasen in diesem Antlitz zu preisen.

Düster ragte die Kuppe des hohen Twiel[16] mit ihren Klingsteinzacken in die Lüfte. Als Denkstein stürmischer Vorgeschichte unserer alten Mutter Erde stehen jene schroffen malerischen Bergkegel in der Niederung, die einst gleich[17] dem jetzigen Becken des Sees von wogender Fluth überströmt war.

NOTES:—

(1) Schießpulver is a compound formed from schießen, *to shoot*, and Pulver, *powder*. (2) Buchdruckerkunst, literally means the art of printing books. (3) Hegau is the name of a province or district in the Duchy of Baden in the south-west of Germany. (4) bleischwer literally means heavy as lead (das Blei, *lead*). (5) wahrzunehmen, active Infinitive with a passive meaning. (6) Bodensee, the lake of Boden, the German name for Lake Constance. (7) Ries, the name of a low-lying plain between Lake Constance and the Black Forest. (8) Gotteshaus is literally a house of God, and hence may stand for a church or any building in which a religious body is accommodated and which contains some place of worship. (9) Schwarzwald, the Black Forest. (10) schwäbisches Meer, the Swabian Sea, i.e. Lake Constance. (11) es genau mit einer Sache nehmen, to be particular about a thing. (12) Alemannen, the Alemanni were a German tribe which inhabited the south-western part of Germany and part of what is now Switzerland. (13) seiner Berge, is genitive dependent on Schnee. (14) Haaren, notice that in German the singular collective hair and the plural hairs are used almost indiscriminately. (15) Hegauer, an

adjective formed from the name Hegau. (16) Twiel is the name of a mountain in the above-mentioned district. (17) gleich, notice the dative after this word.

VOCABULARY

castle, Schloß, s.n.3.
indistinct, unklar.
distance, Entfernung, w.f.
distinguish, unterſcheiden, s.
outline, Umriß, s.m.2.
direction, Richtung, w.f.
bog, Moraſt, s.m.2.
attempt, Verſuch, s.m.2.
brightly, hell.
appear, erſcheinen, s.
to be able, im Stande ſein, können.
feat, Unternehmen, s.n.1.
trial, Verſuch.
venture, ſich wagen, w.
hole, Vertiefung, w.f.
fill, anfüllen, w. sep.
occur, einfallen, s. sep.
follow, verfolgen, w.
route, Weg, s.m.2.
wish, Wunſch, s.m.2.
justify, rechtfertigen, w. insep.
devil, Teufel, s.m.1.
midst, Mitte, w.f.
village, Dorf, s.n.3.
ancient, alt.
protection, Schutz, s.m.
kind, Art, w.f.
come over, ſich bemächtigen, gov. gen.
grim, grimmig.
solitary, einſam.
view, Ausſicht, w.f.
it is true, zwar.
permit, ermöglichen, w. gov. dat.
general, allgemein.
explore, unterſuchen, w. insep.
baffle, vereiteln, w.
cross, überſchreiten, s. insep.
building, Gebäude, s.n.1.
feel ashamed, ſich ſchämen, w.
accomplish, ausführen, w.
seemingly, ſcheinbar.
determine, beſchließen, s.
about to, im Begriff.
surface, Oberfläche, w.f.
yawn, gähnen, w.
soot, Ruß, s.m.
road, Straße, w.f.
convenient, bequem.
object (goal), Ziel, s.n.2.
event, Folge, w.f.
expectation, Erwartung, w.f.
diverge, abweichen, s.
gunshot, Schußweite, w.f.
probably, wahrſcheinlich.
spring up, entſtehen, s.
awe, Furcht, w.f.
approach, ſich nähern.
look, ausſehen, s.
desolate, verödet.
country, Gegend, w.f.

Exercise 76

THE RUINED[1] CASTLE

From the windows of the room where[2] I slept, I had a view of[3] one of these old places,[4] an indistinct one, it is true, the distance being too great to permit[5] one to distinguish more than the general outline. I had an anxious desire[6] to explore it. It stood[7] to[8] the south-east; in which[9] direction, however, a black bog intervened,[10] which had more than once baffled all my attempts to cross it.[11] One morning, however, when the sun shone brightly upon the old building, it appeared so near, that I felt ashamed at[12] not being able to accomplish a feat[13] seemingly so easy; I determined, therefore, upon[14] another trial.

I reached the bog, and was about to venture upon its black surface and to pick my way among its innumerable[15] holes, yawning horribly, and half-filled with water black as soot, when it suddenly occurred to me that there was[16] a road to the south, by[17] following which I might find a more convenient route to[18] the object of my wishes. The event justified my expectations, for, after following[19] the road for[20] some three miles, seemingly in the direction of the Devil's Mountain, I suddenly beheld the castle on my left.[21]

G. H. Borrow.

NOTES:—

(1) *Ruined*, say *in ruins* (Trümmer, plur.). (2) *Where*, say *in which*. (3) *Of*, say *on*. (4) *Places*, say *castles*. (5) *To permit . . .*, als daß ſie es einem ermöglichte (as that it should make it possible to one). (6) *I . . . desire*, mich verlangte ſehr. (7) *Stood*, say *lay*. (8) *To*, gegen. (9) *Which*, say *this*. (10) *Intervene* here best translated by ſich befinden. (11) *Cross it*, say *cross the same*. (12) *At not being able*, say *not to be able*. (13) Say *a seemingly so easy feat*. (14) *Upon . . . attempt*, say *to make another attempt*. (15) *Innumerable . . . water*, say *innumerable, horribly yawning holes, half-filled with water black as soot*. (16) *There was*, es gab. (17) *By . . . following which*, say *if I followed this*. (18) *To*, nach. (19) *Following*, say *I had followed*. (20) Omit *for*. (21) *On my left*, zur Linken.

Key to Exercise 73

As the decisive moment approached, when he was to receive the last Sacrament, as he looked round waiting, and still nothing occurred, he turned to Julian Romero, and asked him once more whether there was no hope of a pardon for him (whether no pardon was to be hoped for for him). Julian Romero shrugged his shoulders, looked down (to the earth) and was silent.

Then he clenched his teeth, threw down his mantle and bed-gown, knelt down on the cushion and began his last prayer. The bishop gave him the crucifix to kiss (caused him to kiss the crucifix), and administered extreme unction, whereupon the earl made a sign to him to leave him. He then drew a silk cap over his eyes, and awaited the blow. . . . Over the corpse and the flowing blood a black cloth was immediately thrown.

All Brussels, which crowded round the scaffold, felt the blow. Loud lamentations (tears) broke the most terrible silence. The duke, who had watched the execution from out of a window, wiped his eyes.

Key to Exercise 74

Ihr verſteht das Gleichniß? Romane ſind Süßigkeiten. Alle Leute mit einem geſunden litterariſchen Appetit lieben ſie — beinahe alle Frauen, — eine ſehr große Anzahl von geſcheiten, verſtändigen Männern. Zum Beiſpiel, einer der gelehrteſten Ärzte in England ſagte mir erſt geſtern: „Ich habe eben So-und-So zum zweitenmal geleſen" (indem er eine von Jones' köſtlichen Dichtungen nannte). Es iſt allgemein bekannt, daß Richter, Biſchöfe, Kanzler, Mathematiker, Romanleſer ſind; wie auch junge Knaben, und liebliche Mädchen, und deren liebe zärtliche Mütter. Wer hat nicht von Eldon geleſen, wie er jede Nacht über Romanen Tränen vergoß, wenn er nicht gerade beim Whiſtſpiel ſaß?

Was den trägen, unartigen Burſchen in Chur betrifft, ſo bezweifle ich, daß er, wenn er dreißig Jahre alt iſt, Romane lieben wird. Er verſchlingt jetzt eine zu große Überfülle davon. Er ißt Leckereien bis ihm übel werden wird. Wenn er zwanzig Jahre alt iſt, wird er die meiſten Verwicklungen kennen, ſo daß es ihn niemals überraſchen wird, wenn der Fremde ſich als der rechtmäßige Graf entpuppt, — wenn der alte Waſſerträger ſeine zerlumpte Kitte abwirft, ſeine Sterne und ſeine verſchiedenen Ordenshalsbänder zeigt, und indem er Antonie an ſeine Bruſt drückt, ſich erweiſt als der Fürſt, ihr längſt verloren geglaubter Vater. Er wird alle Perſonen des Romanſchreibers erkennen, ob ſie in rothackigen Ballſchuhen und "ailes-de-pigeon," oder in der Kleidung des neunzehnten Jahrhunderts erſcheinen.

M. A. L.

RUSSIAN.—XXVIII

Selected Phrases and Terms for the Use of Travellers in Russia

L—In the Carriage (*Continued*)

513. Могу́ ли Вамъ предложи́ть часть моего́ за́втрака? — *May I offer you a part of my breakfast?*
514. Спаси́бо, я закажу́ обе́дъ на слѣ́дующей ста́нціи, — *Thanks, I shall order dinner at the next station.*
515. Почему́ Вы не ку́шаете? — *Why do you not eat?*
516. Спаси́бо, я сытъ по го́рло, — *Thanks, I am quite satisfied* (literally, I am full up to the throat).
517. Какъ здѣсь всё до́рого, дёшево! — *How dear* (cheap) *everything is here!*
518. Кака́я утоми́тельная пое́здка! — *What a wearisome journey!*
519. Како́й прекра́сный видъ! — *What a beautiful view!*
520. Кака́я здѣсь чу́дная приро́да! — *What a beautiful view* (landscape) *it is here!*

M—On Visits

521. До́ма ли господи́нъ Миха́йловъ? — *Is Mr. Michailoff in?*
522. Здѣсь живётъ господи́нъ Жукове́кій, — *Mr. Zhucofsky lives here.*
523. Не зна́ете ли, куда́ перебра́лся господи́нъ Миха́йловъ? — *Could you tell me* (do you not know) *where Mr. Michailoff has removed to?*
524. Справля́йтесь въ а́дресномъ столѣ́, — *Inquire at the directory department.*
525. Бу́дьте любе́зны указа́ть мнѣ а́дресъ господи́на Миха́йлова, — *Give me, please, Mr. Michailoff's address.*
526. Какъ прика́жете о Васъ доложи́ть? — *What name shall I give?*
527. Вотъ моя́ визи́тная ка́рточка, — *Here is my visiting-card.*
528. Здра́вствуйте, — *Good morning.*
529. До́брое у́тро. До́брый ве́черъ, — *Good morning; Good evening.*
530. Споко́йной но́чи, — *Good night.*
531. До свида́нія, — *Au revoir.*
532. Како́й гость! До́бро пожа́ловать! — *What a guest! Welcome!*
533. Какъ радъ Васъ ви́дѣть! — *How pleased I am to see you!*
534. Какъ жена́ и дѣти? — *How are your wife and children?*
535. Спаси́бо, всѣ, сла́ва Бо́гу, жи́вы и здоро́вы, — *Thanks, they are all lively and well.*
536. Какъ у́чатся Ва́ши дѣти? — *Are your children good learners?*
537. Да, они́ всѣ о́чень усе́рдно у́чатся, — *Yes, they are all diligent students.*
538. О́чень радъ слы́шать, — *I am very glad to hear it.*
539. Я привёзъ имъ пода́рки изъ Англіи, — *I have brought over presents from England.*
540. Ты у́мный ма́льчикъ. Я люблю́ тебя́, — *You are a clever boy; I like you.*
541. Какъ тебя́ зову́тъ, мой ми́лый? — *What is your name, my dear?*
542. Лю́бишь ли конфе́кты? — *Do you like toffee?*
543. Да, онъ большо́й люби́тель сластёй, — *Yes, he is a great lover of sweets.*
544. Что у Васъ но́ваго? — *What is new with you?*
545. Что у Васъ сла́вно хоро́шаго? — *How are you getting on?*
546. Какъ пожива́ете? — *How do you do?*
547. Какъ дѣла́? какъ торго́вля? — *How is trade? How is business?*
548. Всё по ста́рому, ми́лый другъ, — *The same old thing, my friend.*
549. Ничего́. Рабо́таемъ, — *Nothing. We keep working.*
550. Успѣва́емъ по немно́жку, — *We go ahead little by little.*
551. Спаси́бо. Дѣла́ иду́тъ не ду́рно, — *Thanks. Business is not going badly.*
552. Не могу́ жа́ловаться, — *I cannot grumble.*
553. Получа́ете ли кру́пные зака́зы? — *Are you getting big orders?*
554. Да, я сча́стливъ въ свои́хъ торго́выхъ опера́ціяхъ, — *Yes, I have good luck in my business transactions.*
555. У Васъ, ви́жу, больша́я перемѣ́на, — *I notice a big change in your place.*
556. Да, я расшири́лъ своё дѣ́ло, — *Yes, I have enlarged my business.*
557. Какъ Вамъ везётъ? — *How do you fare in business?*
558. Дѣ́ло развива́ется успѣ́шно, — (the) *Business is developing favourably.*
559. Что сейча́съ зака́жете? — *What will you order now?*
560. Вы хорошо́ смо́трите, — *You look very well.*
561. Вы значи́тельно попра́вились, — *You have improved a great deal.*
562. Вы похорошѣ́ли, — *You look nicer.*
563. Вы помолодѣ́ли, — *You look younger.*
564. Почему́ Вы такъ торо́питесь? — *Why are you in such a hurry?*
565. У меня́ мно́го дѣ́ла, — *I have a lot to do.*
566. Ничего́, посиди́те ещё съ ча́сикъ, — *Never mind, stay with me about another hour.*
567. Потолку́емъ ещё немно́жко, — *Let us have a chat a bit longer.*
568. Мнѣ, пра́во, не́когда, — *I have really no time.*
569. О, нѣтъ, не уходи́те, пожа́луйста, — *Oh, no, do not go away, please.*
570. Мнѣ такъ прія́тно провести́ съ Ва́ми вре́мя, — *It is so pleasant for me to spend the time with you.*
571. Вы, англича́не, тако́й здра́вомы́слящій наро́дъ! — *You Englishmen are such healthy-minded people.*
572. Я осо́бенно люблю́ ру́сское про́стоду́шіе, — *I particularly like Russian simplicity.*

573. У насъ что́ на душѣ́, то на языкѣ́,
We are straightforward (literally, with us, what is on the mind is on the tongue).

574. Какъ Вамъ нра́вится на́ша обстано́вка?
How do you like our style (in housing, etc.)?

575. У Васъ хоро́шій тонъ,
Your tone is very good.

576. Вы имѣ́ете изы́сканный вкусъ,
You have an exquisite taste.

577. Спаси́бо за компли-име́нтъ,
Thanks for the compliment.

578. Благодарю́ Васъ за раду́шное го́степріи́мство,
Thank you for your kind hospitality.

579. У Васъ во всёмъ ширь и разду́лье,
With you all is on a large scale of comfort.

580. Вѣдь, на то и Россія,
Well, that is just Russia!

N—Soliciting Orders

581. Я жела́ю ви́дѣть хозя́ина, управля́ющаго,
I want to see the principal, the manager.

582. Я не отниму́ у Васъ мно́го вре́мени,
I shall not trespass upon your time very much.

583. Мнѣ надоѣ́ли всѣ э́ти вояжёры,
I am sick and tired of all these commercial travellers.

584. Мнѣ пря́мо тошни́тъ отъ нихъ,
I simply loathe them.

585. У меня́ бо́лѣе ва́жныя дѣла́,
I have something more important to do.

586. Въ то́лько вы́слушайте меня́: не пожалѣ́ете,
Only give me a hearing: you will not regret it.

587. Я представля́ю фи́рму NN. въ Ше́ффильдѣ,
I represent the firm NN. of Sheffield.

588. Я получи́лъ Вашъ катало́гъ и образцы́,
I have received your catalogue and samples.

589. Вашъ това́ръ меня́ не интересу́етъ,
Your goods do not interest me.

590. Вы ещё не вида́ли на́шихъ послѣ́днихъ новосте́й,
You have not seen our latest novelties yet.

591. Они́ не вошли́ въ нашъ катало́гъ,
They have not been included in our catalogue.

592. Мы произвели́ соверше́нно но́вые патенты,
We have brought out absolutely new patents.

593. Что за по́льза въ э́тихъ патентахъ?
What is the good of these patents?

594. Они пока́зываютъ значи́тельныя усовершенствованія,
They show considerable improvements.

595. Я не жела́ю имѣ́ть нови́нокъ и усовершенствованій,
I do not want to have any novelties and improvements.

596. Я вполнѣ́ довóленъ ста́рымъ поря́дкомъ вещей,
I am quite satisfied with the old state of things.

597. Не говори́те э́того, пожа́луйста,
Do not say that, please.

598. Ва́ша фи́рма одна́ изъ передовы́хъ въ Россіи,
Yours is one of the leading firms in Russia.

599. Мы всѣ немину́емо должны́ считаться съ прогрессомъ дня,
We must all unavoidably count (keep pace) *with progress of the day.*

600. Комме́рція шага́етъ впередъ, а не наза́дъ,
Commerce strides forward, and not backward.

601. Жа́лко Ва́шего вре́мени: я ничего́ не куплю́,
It is a pity about your time; I shall buy nothing.

602. Я не наста́иваю на Вашъ неме́дленный зака́зъ,
I do not insist upon your immediate order.

603. Прошу́ Васъ, гля́ньте то́лько на мои́ образцы́,
Please, glance only at my samples.

604. Оно́ Вамъ ничего́ не бу́детъ сто́ить,
It will cost you nothing.

605. Уходи́те, пожа́луйста, не моро́чьте меня́,
Go away, please, do not bother me.

606. Я не могу́ тра́тить вре́мени понапра́сну,
I cannot waste time for nothing.

607. Не бу́дьте такъ жесто́ки,
Do not be so hard.

608. Я на́рочно прiѣха́лъ, что́бы повида́ться съ Ва́шей фи́рмой,
I have especially come over to see your firm.

609. У меня́ по́лно това́ру,
I have a plentiful supply of goods.

610. У меня́, пра́во, сейча́съ нѣтъ на́добности въ това́рѣ,
I have really no need for goods now.

611. Посмотри́те всё таки́ на мои́ образцы́, любопы́тства ра́ди,
Nevertheless have a look at my samples, for the sake of curiosity.

612. Вѣкъ живи́, вѣкъ учи́сь, зна́ете,
Live and learn, you know.

613. Вы тамъ найдёте интере́сныя ве́щи,
You will find there interesting things.

614. У Васъ бу́дутъ спра́шивать э́ти предме́ты,
You will be asked for these things (articles).

615. На́ши издѣ́лія хорошо́ извѣ́стны въ Россіи,
Our goods are well known in Russia.

616. Я по о́пытности зна́ю, что Вы бу́дете имѣ́ть на нихъ хоро́шій сбытъ,
I know from experience that you will have a good sale of them.

617. Мы конкурри́руемъ не цѣно́й, а ка́чествомъ,
We compete with the quality, not with price.

618. На́ше до́брое и́мя намъ доро́же де́негъ,
Our good name is more valuable to us than money.

619. Куй желѣ́зо, пока́ горя́чо,
Strike the iron while it is hot.

620. Введи́те у себя́ э́тотъ предме́тъ и бу́дьте пе́рвымъ въ ры́нкѣ,
Introduce this article at your place and be the first in the market.

621. Тепе́рь пора́, пока́ ещё нѣтъ си́льной конкурре́нціи,
Now is the time while there is no keen competition (yet).

622. Сов'ѣтую Вамъ воспо́льзоваться удо́бнымъ слу́чаемъ, — *I advise you to take advantage of a good opportunity.*

623. Съ увеличе́ніемъ спро́са мы увели́чимъ на́ши цѣны, — *When the demand increases, we shall raise our prices.*

624. При кру́пныхъ зака́захъ мы огради́мъ Ва́ши интере́сы, — *In case of big orders we shall protect your interests.*

625. Мы гото́вы оказа́ть Вамъ вся́кое содѣ́йствіе къ распростране́нію на́шихъ издѣ́лій, — *We are willing* (prepared) *to lend you any help for the spreading of our manufactures.*

O—Various Business Topics

626. Э́то цѣна́ за нали́чный разсчёть, — *This is the cash price.*

627. Мы не мо́жемъ согласи́ться на до́лгіе сро́ки, — *We cannot consent to long terms.*

628. Мы не банки́ры, а фабрика́нты, — *We are not bankers, but manufacturers.*

629. Намъ сами́мъ ну́жны грома́дные капита́лы для оборо́та, — *We ourselves require huge capital for the turnover.*

630. Пусть себѣ́ другіе мѣня́ютъ рубль за рубль, — *Let other people change a rouble for a rouble.*

631. Пусть конкурре́нція продаётъ ни́же со́бственной сто́имости, — *Let the competitors sell below cost price.*

632. Намъ нѣтъ на́добности продава́ть това́ръ съ убы́ткомъ, — *We do not need to sell goods at a loss.*

633. Я о́чень недово́ленъ Ва́шей фи́рмой, — *I am very discontented with your firm.*

634. Что за причи́на э́тому? — *What is the cause of it?*

635. Ну, изъ-за э́того ссо́риться не бу́демъ, — *Well, we shall have no quarrel over that.*

636. Мы Васъ надлежа́ще удовлетвори́мъ и всё бу́детъ опя́ть въ поря́дкѣ, — *We shall give you proper satisfaction, and everything will be in order again.*

637. Позво́льте мнѣ навести́ у Васъ спра́вку о фи́рмѣ Д, — *Allow me to inquire from you about the firm D.*

638. Весьма́ сожалѣ́ю, я не имѣ́ю малѣ́йшаго поня́тія объ э́той фи́рмѣ, — *Very sorry, I have not the slightest idea about this firm.*

639. Я въ чужія дѣла́ не вмѣ́шиваюсь, — *I do not meddle with other people's business.*

640. Чи́стосерде́чно говоря́, она́ мнѣ не нра́вится, — *Candidly speaking, I am not in favour of it.*

641. Намъ причита́ется за нимъ ма́ленькій должо́къ, — *He owes us a small balance.*

642. А, э́то пло́хо, — *Ah, this is bad.*

643. Онъ перемѣни́лъ свою́ фи́рму, — *He has changed his firm.*

644. Онъ куда́-то скры́лся, — *He is in hiding somewhere.*

645. Э́тотъ подле́цъ надѣ́лалъ мно́го па́костей, — *This scoundrel has done a lot of mischief.*

646. Его мѣ́стонахожде́ніе неизвѣ́стно, — *His whereabouts are unknown.* **A. C.**

GREEK.—XV

Verbs in -μι (*continued*) Passive and Middle Voices

Present

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	ἵσταμαι	ἱστῶμαι	ἱσταίμην		ἵστασθαι	ἱστάμενος, ἱσταμένη, ἱστάμενον
2.	ἵστασαι	ἱστῇ	ἵσταιο	ἵστασο		
3.	ἵσταται	ἱστῆται	ἵσταῖτο	ἱστάσθω		
Dual 2.	ἵστασθον	ἱστῆσθον	ἱσταῖσθον	ἵστασθον		
3.	ἵστασθον	ἱστῆσθον	ἱσταίσθην	ἱστάσθων		
Plur. 1.	ἱστάμεθα	ἱστώμεθα	ἱσταίμεθα			
2.	ἵστασθε	ἱστῆσθε	ἱσταῖσθε	ἵστασθε		
3.	ἵστανται	ἱστῶνται	ἱσταῖντο	ἱστάσθων or ἱστάσθωσαν		

Imperfect

Sing. 1.	ἱστάμην
2.	ἵστασο
3.	ἵστατο
Dual 2.	ἵστασθον
3.	ἱστάσθην
Plur. 1.	ἱστάμεθα
2.	ἵστασθε
3.	ἵσταντο

2nd Aorist

Sing. 1.	ἐπριάμην	πρίωμαι	πριαίμην		πρίασθαι	πριάμενος, πριαμένη, πριάμενον
2.	ἐπρίω	πρίῃ	πρίαιο	πρίω		
3.	ἐπρίατο	πρίηται	πρίαιτο	πριάσθω		
Dual 2.	ἐπρίασθον	πρίησθον	πρίαισθον	πρίασθον		
3.	ἐπριάσθην	πρίησθον	πριαίσθην	πριάσθων		
Plur. 1.	ἐπριάμεθα	πριώμεθα	πριαίμεθα			
2.	ἐπρίασθε	πρίησθε	πρίαισθε	πρίασθε		
3.	ἐπρίαντο	πρίωνται	πρίαιντο	πριάσθων or πριάσθωσαν		

Present

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	τίθεμαι	τιθῶμαι	τιθείμην or τιθοίμην		τίθεσθαι	τιθέμενος, τιθεμένη, τιθέμενον
2.	τίθεσαι	τιθῇ	τιθεῖο or τιθοῖο	τίθεσο or τίθου		
3.	τίθεται	τιθῆται	τιθεῖτο or τιθοῖτο	τιθέσθω		
Dual 2.	τίθεσθον	τιθῆσθον	τιθεῖσθον	τίθεσθον		
3.	τίθεσθον	τιθῆσθον	τιθείσθην	τιθέσθων		
Plur. 1.	τιθέμεθα	τιθώμεθα	τιθείμεθα			
2.	τίθεσθε	τιθῆσθε	τιθεῖσθε	τίθεσθε		
3.	τίθενται	τιθῶνται	τιθεῖντο	τεθέσθων or τιθέσθωσαν		

Imperfect

Sing. 1.	ἐτιθέμην
2.	ἐτίθεσο
3.	ἐτίθετο
Dual 2.	ἐτίθεσθον
3.	ἐτιθέσθην
Plur. 1.	ἐτιθέμεθα
2.	ἐτίθεσθε
3.	ἐτίθεντο

2nd Aorist

Sing. 1.	ἐθέμην	θῶμαι	θείμην		θέσθαι	θέμενος, θεμένη, θέμενον
2.	ἔθου	θῇ	θεῖο	θοῦ		
3.	ἔθετο	θῆται	θεῖτο	θέσθω		
Dual 2.	ἔθεσθον	θῆσθον	θεῖσθον	θέσθον		
3.	ἐθέσθην	θῆσθον	θείσθην	θέσθων		
Plur. 1.	ἐθέμεθα	θώμεθα	θείμεθα			
2.	ἔθεσθε	θῆσθε	θεῖσθε	θέσθε		
3.	ἔθεντο	θῶνται	θεῖντο	θέσθων or θέσθωσαν		

Present

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	δίδομαι	διδῶμαι	διδοίμην		δίδοσθαι	διδόμενος, διδομένη, διδόμενον
2.	δίδοσαι	διδῷ	διδοῖο	δίδοσο or δίδου		
3.	δίδοται	διδῶται	διδοῖτο	δίδοσθω		
Dual 2.	δίδοσθον	διδῶσθον	διδοῖσθον	δίδοσθον		
3.	δίδοσθον	διδῶσθον	διδοίσθην	διδόσθων		
Plur. 1.	διδόμεθα	διδώμεθα	διδοίμεθα			
2.	δίδοσθε	διδῶσθε	διδοῖσθε	δίδοσθε		
3.	δίδονται	διδῶνται	διδοῖντο	δίδοσθων or διδόσθωσαν		

Imperfect

Sing. 1.	ἐδιδόμην
2.	ἐδίδοσο
3.	ἐδίδοτο
Dual 2.	ἐδίδοσθον
3.	ἐδιδόσθην
Plur. 1.	ἐδιδόμεθα
2.	ἐδίδοσθε
3.	ἐδίδοντο

2nd Aorist

Sing. 1.	ἐδόμην	δῶμαι	δοίμην		δόσθαι	δόμενος, δομένη, δόμενον
2.	ἔδου	δῷ	δοῖο	δοῦ		
3.	ἔδοτο	δῶται	δοῖτο	δόσθω		
Dual 2.	ἔδοσθον	δῶσθον	δοῖσθον	δόσθον		
3.	ἐδόσθην	δῶσθον	δοίσθην	δόσθων		
Plur. 1.	ἐδόμεθα	δώμεθα	δοίμεθα			
2.	ἔδοσθε	δῶσθε	δοῖσθε	δόσθε		
3.	ἔδοντο	δῶνται	δοῖντο	δόσθων or δόσθωσαν		

Present

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	δείκνῦμαι	δεικνύωμαι	δεικνυοίμην		δείκνυσθαι	δεικνύμενος, δεικνυμένη, δεικνύμενον
2.	δείκνῦσαι	δεικνύῃ	δεικνύοιο	δείκνῦσο		
3.	δείκνῦται	δεικνύηται	δεικνύοιτο	δεικνύσθω		
Dual 2.	δείκνυσθον	δεικνύησθον	δεικνύοισθον	δείκνυσθον		
3.	δείκνυσθον	δεικνύησθον	δεικνυοίσθην	δεικνύσθων		
Plur. 1.	δεικνῦμεθα	δεικνυώμεθα	δεικνυοίμεθα			
2.	δείκνυσθε	δεικνύησθε	δεικνύοισθε	δείκνυσθε		
3.	δείκνυνται	δεικνύωνται	δεικνύοιντο	δεικνύσθων or δεικνύσθωσαν		

	Indicative.	IMPERFECT
Sing. 1.	ἐδεικνύμην	
2.	ἐδείκνῦσο	
3.	ἐδείκνῦτο	
Dual 2.	ἐδείκνυσθον	
3.	ἐδεικνύσθην	
Plur. 1.	ἐδεικνύμεθα	
2.	ἐδείκνυσθε	
3.	ἐδείκνυντο	

Of the first perfect of ἵστημι only the singular forms, ἕστηκα, -ας, -ε, are in common use. In the same way ἔθηκα, ἔδωκα, βέβηκα, *have gone*, and τέθνηκα, *have died*, occur only in the singular, except that the plural ἔθηκαν is sometimes found. For the other numbers the following forms are used :—

Indicative, ἕστᾰτον, ἕστατον, ἕσταμεν, ἕστατε, ἑστᾶσι(ν).
Subjunctive, ἑστῶ, ἑστῇς, ἑστῇ, etc.
Optative, ἑσταίην, ἑσταίης, ἑσταίη, ἑσταίητον or ἑσταῖτον, etc.
Imperative, ἕστᾰθι, ἑστάτο, ἕστατον, etc.
Infinitive, ἑστάναι.
Participle, ἑστώς, ἑστῶσα, ἑστός.

Similarly in the pluperfect the singular forms εἱστήκη (or ἑστήκη), -ης, -ει(ν) are used, but in the dual and plural the second pluperfect forms ἕστατον, ἑστάτην, ἕσταμεν, ἕστατε, ἕστασαν.

Verbs in -μι, First Class

THE class of verbs nearest in form to the typical examples conjugated fully in the last two lessons are those with reduplicated present stems, like ἵστημι, τίθημι, and δίδωμι. This includes :—

κίχρημι, *lend* (stem χρᾰ-), κίχραναι, χρήσω, ἔχρησα, mid., *borrow*, χρήσομαι, κέχρημαι, ἐχρησάμην.

ὀνίνημι, *benefit* (ὀνᾰ), ὀνήσω, ὤνησα ; mid. ὀνίναμαι, *derive benefit*, ὀνήσομαι, 2nd. aor. ὠνήμην (or ὠνάμην), -ησο, -ητο, etc., opt. ὀναίμην, -αιο, -αιτο, inf. ὄνασθαι ; aor. pass. ὠνήθην. (The other parts were supplied by ὠφελεῖν, *benefit*.)

ἵημι, *send* (ἑ-), is inflected as follows :—

ACTIVE VOICE

PRESENT

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	ἵημι	ἱῶ	ἱείην		ἱέναι	ἱείς ἱεῖσα, ἱέν
2.	ἵης	ἱῇς	ἱείης	ἵει		
3.	ἵησι (ν)	ἱῇ	ἱείη	ἱέτω		
Dual 2.	ἵετον	ἱῆτον	ἱεῖτον	ἵετον		
3.	ἵετον	ἱῆτον	ἱείτην	ἱέτων		
Plur. 1.	ἵεμεν	ἱῶμεν	ἱεῖμεν			
2.	ἵετε	ἱῆτε	ἱεῖτε	ἵετε		
3.	ἱᾶσι (ν)	ἱῶσι (ν)	ἱεῖεν	ἱέντων		

IMPERFECT

Sing. 1.	ἵειν (rarely ἵην)
2.	ἵεις
3.	ἵει
Dual 2.	ἵετον
3.	ἱέτην
Plur. 1.	ἵεμεν
2.	ἵετε
3.	ἵεσαν
Future.	ἥσω, ἥσεις, ἥσει, etc.

AORIST

	Indicative. 1st.	2nd.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*
Sing. 1.	ἧκα (ἀφῆκα)		ὦ (ἀφῶ)	εἵην		εἶναι (ἀφεῖναι)
2.	ἧκας		ἧς (ἀφῇς)	εἵης	ἕς (ἄφες)	
3.	ἧκε (ν)		ᾗ	εἵη	ἕτω	*Participle.*
Dual 2.		εἷτον (ἀφεῖτον)	ἧτον	εἷτον or εἵητον	ἕτον (ἄφετον)	εἷς, εἷσα, ἕν (ἀφείς, ἀφεῖσα, ἀφέν)
3.		εἵτην	ἧτον	εἵτην or εἱήτην	ἕτων	
Plur. 1.		εἷμεν (καθεῖμεν)	ὦμεν	εἷμεν or εἵημεν		
2.		εἷτε (ἀνεῖτε)	ἦτε	εἷτε or εἵητε	ἕτε (ἄφετε)	
3.	ἧκαν	εἷσαν (ἀφεῖσαν)	ὦσι (ν)	εἷεν or εἵησαν	ἕντων or ἕτωσαν	
Perfect.	εἷκα, εἷκας, εἷκε, etc. (in ἀφεῖκα, etc.)					
Plup.	εἵκη, etc.					

PASSIVE AND MIDDLE

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Present.	ἵεμαι, etc.	ἱῶμαι, etc.	ἱείμην, etc.	ἵεσο or ἵου	ἵεσθαι	ἱέμενος, ἱεμένη, ἱέμενον
Imperfect.	ἱέμην					
Future Middle.	ἥσομαι, etc.					
Future Passive.	ἐθήσομαι					

	Indicative.	*Imperative.*	*Infinitive.*	*Participle.*
Perfect.	εἶμαι, etc. (in μεθείμαι, etc.)	εἴσθω, etc.	εἶσθαι (μεθεῖσθαι)	εἰμένος
Pluperfect.	εἵμην			
1st *Aorist Middle*	ἡκάμην (rare, and only in indicative)			

2nd *Aorist Middle.*

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	εἵμην	ὦμαι (ἀφῶμαι)	εἵμην		ἕσθαι	ἕμενος, ἑμένη,
2.	εἶσο	ᾗ (ἀφῇ)	εἶο	οὗ (ἀφοῦ)		ἕμενον
3.	εἶτο	ἧται (ἀφῆται)	εἶτο	ἕσθω		
Dual 2.	εἶσθον	ἧσθον	εἶσθον	ἕσθον		
3.	εἴσθην	ἧσθον	εἰσθήν	ἕσθων		
Plur. 1.	εἵμεθα	ὥμεθα	εἵμεθα			
2.	εἶσθε	ἧσθε	εἶσθε	ἕσθε		
3.	εἶντο	ὦνται	εἶντο	ἕσθων		
1st *Aorist Passive.*	εἴθην	ἐθῶ		ἐθῆναι		ἐθείς

Verb. Adj., ἑτός, ἑτέος (ἀφετός)

The verbs in -μι that do not reduplicate but keep the simple stem in the present tense comprise:—

εἰμί, *am* (fully conjugated in Lesson XV.); εἶμι, *shall go* (conjugated below); ἧμαι, *sit*, κεῖμαι, *lie*, φημί, *say*.

χρή, *ought, behoves, it is necessary* (impers.), subj. χρῇ, opt. χρείη, infin. χρῆναι, part. τὸ χρεών, imperf. ἐχρῆν or χρῆν, fut. χρήσει.

ἀπόχρη, *it suffices*, infin. ἀποχρῆν, imperf. ἀπέχρη, fut. ἀποχρήσει, aor. ἀπέχρησε(ν).

εἶμι (stem ἰ-), *shall go*

PRESENT

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	εἶμι	ἴω	ἴοιμι or ἰοίην		ἰέναι	ἰών, ἰοῦσα ἰόν,
2.	εἶ	ἴῃς	ἴοις or ἰοίης	ἴθι		G. ἰόντος, ἰούσης
3.	εἶσι (ν)	ἴῃ	ἴοι or ἰοίη etc.	ἴτω		(παριών, παριοῦσα,
Dual 2.	ἴτον	ἴητον	ἴοιτον	ἴτον		παριόν, G. παριόντος)
3.	ἴτον	ἴητον	ἰοίτην	ἴτων		
Plur. 1.	ἴμεν	ἴωμεν	ἴοιμεν			
2.	ἴτε	ἴητε	ἴοιτε	ἴτε		
3.	ἴᾶσι (ν)	ἴωσι (ν)	ἴοιεν	ἴτωσαν οἱ ἰόντων		

IMPERFECT

Sing. 1.	ᾔειν or ᾖα, *I went.*
2.	ᾔεις or ᾔεισθα
3.	ᾔει or ᾔειν
Dual 2.	ᾔειτον or ᾖτον
3.	ᾐείτην or ᾔτην
Plur. 1	ᾔειμεν or ᾖμεν
2.	ᾔειτε or ᾖτε
3.	ᾔεσαν or ᾖσαν

Verb. Adj., ἰτός, ἰτέον, ἰτητέον

φημί (stem φᾰ-), *say*

ACTIVE VOICE

PRESENT

	Indicative.	*Subjunctive.*	*Optative.*	*Imperative.*	*Infinitive.*	*Participle.*
Sing. 1.	φημί	φῶ	φαίην		φάναι	φάς, φᾶσα, φάν;
2.	φής	φῇς	φαίης	φᾶθι or φᾶθί		G. φάντος, φάσης,
3.	φησί(ν)	φῇ	φαίη	φᾶτω		etc., not Attic
Dual 2.	φᾶτόν	φῆτον	φαίητον (φαῖτον)	φᾶτον		
3.	φᾶτόν	φῆτον	φαιήτην (φαίτην)			
Plur. 1.	φᾰμέν	φῶμεν	φαίημεν (φαῖμεν)	φάτων		
2.	φᾶτέ	φῆτε	φαίητε (φαῖτε)	φᾶτε		
3.	φᾶσί(ν)	φῶσι(ν)	φαῖεν	φᾶτωσαν (φάντων)		

IMPERFECT

Sing. 1.	ἔφην
2.	ἔφησθα or ἔφης
3.	ἔφη
Dual 2.	ἔφᾶτον
3.	ἐφάτην
Plur. 1.	ἔφᾰμεν
2.	ἔφᾶτε
3.	ἔφᾶσαν
Future.	φήσω
Aorist.	ἔφησα

PASSIVE

Perfect Imperative, πεφάσθω, *let it be said* *Verb. Adj.*, φατός, φατέος.

ἧμαι (stem ἡσ-), *sit*

Perf. (with present meaning). ἧμαι, ἧσαι, ἧσται, ἧσθον; ἥμεθα, ἧσθε, ἧνται; imperat. ἧσο, ἥσθω, etc.; inf. ἧσθαι; part. ἥμενος.

Plup. (with meaning of imperfect). ἥμην, ἧσο, ἧστο; ἧσθον, ἥσθην; ἥμεθα, ἧσθε, ἧντο.

Perfect (with meaning of present). κάθημαι, κάθησαι, κάθηται; subj. καθῶμαι, καθῇ, καθῆται, etc.; opt. καθοίμην, κάθοιο, κάθοιτο; imperat. κάθησο or κάθου; inf. καθῆσθαι; part. καθήμενος.

Pluperf. (with meaning of imperfect). ἐκαθήμην and καθήμην, ἐκάθησο and καθῆσο, ἐκάθητο and καθῆστο.

κεῖμαι (stem κει-), *lie*

Perf. Ind. κεῖμαι, κεῖσαι, κεῖται, κεῖσθον; κείμεθα, κεῖσθε, κεῖνται; subj. 3 sing. κέηται; opt. 3 sing. κέοιτο; imperat. κεῖσο, κεῖσθω, etc.; inf. κεῖσθαι; part. κείμενος.

Plup. Ind. ἐκείμην, ἔκεισο, ἔκειτο, 3 plur. ἔκειντο.

Fut. κείσομαι.

The pres. ind. of φημί (except the 2nd person singular) is an enclitic, throwing its accent back on the preceding word. The following deponents belong to this group:—

ἄγαμαι, *admire* (stem ἀγα-), ἠγάμην, ἠγάσθην, ἠγᾰσάμην, ἀγάσομαι.

δύναμαι, *am able, can* (δυνα-), subj. δύνωμαι, imper. δύνασο, infin. δύνασθαι, part. δυνάμενος, imperf. ἐδυνάμην or ἠδυνάμην, ἐδύνω or ἠδύνω, etc.; fut. δυνήσομαι, perf. δεδύνημαι; aor. ἐδυνήθην or ἠδυνήθην (rarely ἐδυνάσθην); verb. adj. δυνατός, *able, strong, possible.*

ἐπίσταμαι, *understand* (ἐπιστα-), subj. ἐπίστωμαι, imper. ἐπίστω, imperf. ἠπιστάμην, fut. ἐπιστήσομαι, aor. ἠπιστήθην, verb. adj. ἐπιστητός.

ἔραμαι, *love* (stem ἐρα-; in pres. and imperf. ἐράω is used in prose), aor. ἠράσθην, fut. ἐρασθήσομαι.

Verbs in -μι, Second Class

The only one of the verbs in νυμι (which insert -νυ- between the stem and the termination, -ννυ- after a vowel) that has a 2nd aorist is σβέννυμι, *quench*; the others follow the inflexion of δείκνυμι, and have forms peculiar to verbs in -μι only in the present and perfect. The 2nd aorist of σβέννυμι is ἔσβην.

This class of verbs includes the following:—

Verbs with stems in -α

κεράννῡμι, *mix* (κερα-, κρα-), fut. κεράσω 1st aor. ἐκέρᾱσα, perf. κέκρᾱκα, perf.-mid. κέκρᾱμαι, aor. pass. ἐκρᾰ́θην and ἐκεράσθην, aor. mid. ἐκερασάμην, fut. pass. κραθήσομαι.

κρεμάννῡμι, *hang* (tr.) (κρεμα-), fut. κρεμῶ (κρεμάσω), aor. ἐκρέμᾱσα, aor. pass. ἐκρεμάσθην, fut. κρεμασθήσομαι.

πετάννῡμι, *spread out, expand* (πετᾰ́-, πτᾰ́-), fut. πετάσω (Attic πετῶ), aor. ἐπέτασα, perf. pass. πέπτᾰμαι, aor. ἐπετάσθην.

Verbs with Stems in -ε

ἕννῡμι, *clothe* (in prose ἀμφιέννῡμι) (stem ἑ-, orig. ἑσ- (*Fεσ-*, cp. Latin *vestīō*), fut. ἀμφιέσω (Attic ἀμφιῶ), aor. ἠμφίεσα, mid. ἀμφιέννῡμαι, *put on*, fut. ἀμφιέσομαι, perf. pass. ἠμφίεσμαι, -εσαι, -εσται, etc., infin. ἠμφιέσθαι; σβέννῡμι, *extinguish* (σβε-), σβέσω, ἔσβεσα, 2nd aor. ἔσβην, *went out, was extinguished*, perf. ἔσβηκα, *has been extinguished*; mid. σβέννυμαι, *go out*, perf. ἔσβεσμαι, fut. σβήσομαι, aor. pass. ἐσβέσθην; στόρνυμι (for στορέννῡμι), *strew* (στορε-), fut. στορῶ (στορέσω), aor. ἐστόρεσα.

Examples of Verbs with Stems in -ω

ζώννῡμι, *gird* (ζω-), ζώσω, ἔζωσα, aor. mid. ἐζωσάμην, perf. pass. ἔζωσμαι.

ῥώννῡμι, *strengthen* (ῥω-), ῥώσω, ἔρρωσα; perf. pass. ἔρρωμαι (*I am strong*; ἔρρωσο, *farewell*, cp. Latin vălē); aor. pass. ἐρρώσθην.

Examples of Verbs with Consonantal Stems

ἄγνῡμι, *break* (αγ-, *Fαγ-*) (in prose only κατάγνῡμι), ἄξω, ἔαξα (κατέαξα), 2nd perf. ἔᾱγα (in κατέᾱγα), 2nd aor. pass. ἐᾱ́γην (κατεᾱ́γην).

εἴργνυμι or εἰργνύω (εἴργω), *enclose, restrain* (εἰργ-), εἴρξω, εἶρξα, εἴργμαι, εἶρχθην.

ζεύγνῡμι, *yoke* (ζευγ- ζῦγ-), ζεύξω, ἔζευξα; perf pass. ἔζευγμαι, 1st aor. ἐζεύχθην, 2nd aor. ἐζύγην.

μίγ-νῡ-μι, *mix* (μιγ-); fut. μίξω; aor. ἔμιξα; perf. pass. μέμιγμαι; 1st aor. pass. ἐμίχθην, 2nd aor. ἐμίγην; fut. pass. μιχθήσομαι.

VOCABULARY

γελοῖος, -α, -ον, *absurd.*
ἐπιμελής, -ές, *careful, attentive.*
ἰατρικός, -ή, -όν, *pertaining to medicine.*
καθοράω, *to look down, to regard* or *view.*
κομίζω, *take care of, carry away.*
κρῠ́φα (Doric for Attic κρῠφῇ), *secretly.*
λοιπός, -ή, -όν, *remaining*; τὰ λοιπά, *the rest.*
μεθίημι, *let, allow, neglect.*
ἀποτίνω, *atone for, pay for, punish.*
ἀποτρέχω, *run away.*
ἀποφεύγω, *flee, escape.*
διαφθείρω, *destroy.*
εἵλω, *roll up, press together, collect.*
κοτύλη, ἡ, *something hollow, a cup* or *socket.*
μεταστρέφω, *turn round.*
ξῠρόν, τό, *razor.*
οἰκονομία, -ας, ἡ, *economy, household management.*
προσήκω, *come, belong to*; οἱ προσήκοντες, *one's kinsmen.*
τεκτονικός, -ή, -όν, *pertaining to carpentry or building.*
χαλκευτικός, -ή, -όν, *pertaining to smith's work or metallurgy.*
μήν, ὁ, μηνός, *month.*
πλήσσω, *wound, strike.*
σκοπός, ὁ, *watcher, look-out, mark.*
συμβαίνω, *go with, go together*; impers. συμβαίνει, *it happens.*

Note:—As a rule, only words having some peculiarity of meaning or usage to which special attention is drawn will now be given in the vocabularies. The student is strongly recommended to hunt up in the lexicon the exact sense of any word causing him the slightest difficulty

From the painting by Hogarth

THE LIFE SCHOOL IN HOGARTH'S ACADEMY.

Opened in 1734 in a studio, formerly occupied by Roubiliac the sculptor, at the end of St. Peter's Court, St. Martin's Lane, London, the academy existed for some thirty years as a school for the nude. It was the immediate predecessor of the Royal Academy.

Exercise 15

(*a*) Translate into English :—

1. Ὁ ἀγαθὸς οὔποτε μεθήσει τὰ δέοντα πράσσειν. 2. Ἐπὶ ξυροῦ ἵσταται ἀκμῆς. 3. Νοσήσας δὲ ἐτελεύτησε τὸν βίον. 4. Τὰ δὲ ὀστᾶ φασι κομισθῆναι αὐτοῦ οἱ προσήκοντες οἴκαδε, κελεύσαντος ἐκείνου, καὶ τεθῆναι κρύφα Ἀθηναίων ἐν τῇ Ἀττικῇ. 5. Τὰ μὲν κατὰ Παυσανίαν τὸν Λακεδαιμόνιον καὶ Θεμιστοκλέα τὸν Ἀθηναῖον, λαμπροτάτους γενομένους τῶν καθ ἑαυτοὺς Ἑλλήνων, οὕτως ἐτελεύτησεν.

(*b*) Translate into Greek :—

1. There are two things still left to be observed in the city. 2. Death is called a brazen sleep. 3. Many unfortunate things had befallen the soldiers on the expedition. 4. He had married the daughter of Theagenes, a Megarian man who during that period was tyrant of Megara. 5. Do I not then seem to you ridiculous, Socrates? 6. Now should we not be ashamed to imitate the king of the Persians?

Exercise 16

(*a*) Translate into English :—

1. Ἀλλ' εὖ γε μέν τοι ἐπιστάσθων ὅτι οὔτε ἀποδεδράκασιν οἶδα γὰρ ὅπῃ οἴχονται οὔτε ἀποπεφεύγασιν. 2. Καὶ οὗτος μὲν δὴ ὁ λόγος οὐκ ἀπὸ τοῦ σκοποῦ ἔδοξεν εἰρῆσθαι. 3. Ἐδίδοσαν γὰρ αὐτῶν ἑκάστῳ ἐπὶ ὀκτὼ μῆνας κοτύλην ὕδατος καὶ δύο κοτύλας σίτου καθ' ἡμέραν. 4. Ὁ στρατηγὸς τοὺς πολεμίους ἔφθασεν εἰς τὴν πόλιν ἐλθών. 5. Πολλὰ κακὰ τοῖς ἐμοῖς παισὶ συνέβη ἐνθάδε ἐρχομένοις. 6. Τὸν κακοῦργον ἐκεῖνον Ἀπόλλων ἀποτίσαι.

(*b*) Translate into Greek :—

1. By mingling with the wise thou thyself shalt also turn out wise. 2. May the gods punish the evildoers. 3. The citizens outstripped the enemy in their flight into the city. 4. The fruit of wisdom shall never be destroyed. 5. The rich man is not he who has much, but he who wants little.

Key to Exercise 14

(*a*) 1. The good man will never fail to do his duty. 2. Many pursue the unknown, letting go that which is known. 3. Xerxes let fetters down into the Hellespont. 4. Not by the tongue but by deeds may a man become my friend. 5. Be just, that ye may obtain that which is just.

(*b*) 1. Μὴ δίωκε τὰ ἄφαντα ἀφεὶς τὰ φανερά. 2. Πολλοὶ ἄνθρωποι ἐφίενται πλούτου. 3. Ἡέδας λέγουσιν εἰς τὸν Ἑλλήσποντον καθεῖναι Ξέρξην. 4. Ὁ Νειλος ἐξίησιν εἰς τὴν θάλασσαν ἑπτὰ στομάσιν. 5. Ἄττα ἔπειτ ἔσται ταῦτα θεοῖς μέλει.

Key to Exercise 15

(*a*) 1. The good man will never fail to do that which is necessary. 2. It stands upon a razor's edge. 3. Falling sick he ended his life. 4. His kinsmen say that his remains were carried home at his command, and buried unknown to the Athenians in Attica. 5. Thus ended the things concerning Pausanias the Lacedæmonian and Themistocles the Athenian, who had become the most illustrious of the Greeks in their day.

(*b*) 1. Δύο ἔτι λοιπὰ ἃ δεῖ κατιδεῖν ἐν τῇ πόλει. 2. Ὁ θάνατος λέγεται χαλκοῦς ὕπνος. 3. Τοῖς στρατιώταις ἐν τῇ στρατίᾳ πολλὰ κακὰ συνεβεβήκει. 4. Ἐγεγαμήκει δὲ θυγατέρα Θεαγένους, Μεγαρέως ἀνδρὸς ὃς κατ' ἐκεῖνον τὸν χρόνον ἐτυράννει Μεγάρων. 5. Οὔκουν γελοῖός σοι φαίνομαι εἶναι, ὦ Σώκρατες; 6. Ἆρ' οὐκ αἰσχυνθῶμεν τὸν Περσῶν βασιλέα μιμήσασθαι.

E. A. B.

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ITALIAN.—XVI

Distributive and Collective Numerals.—These are summarised as follows :—

Un terzo, *one third.*	un lustro, *five years.*
la metà, *the half.*	una volta, *once.*
il doppio, *the double.*	due volte, *twice.*
una coppia, *a couple.*	ad uno ad uno, *one by one.*
una dozzina, *a dozen.*	
una ventina, *a score.*	a due a due, *two by two.*
un trimestre, *three months.*	

Both is rendered by **tutte e due, ambo, ambidue, ambedue, entrambo, entrambi :** *all three*, etc., is translated by **tutti e tre,** etc., the noun which follows being preceded by the definite article, as : **Tutti e due i libri,** *Both books ;* **Tutt'e quattro le fatture,** *All four invoices.*

Miscellaneous Examples :—

Hanno tante pezze quante scátole.	*They have as many pieces as boxes.*
Davvero loro sono meno diligenti di me.	*Really, they are less diligent than I.*
Il nostro campione è meno bello del vostro.	*Our pattern is less beautiful* (not so nice) *as yours.*
Questi e quello sono miei.	*These and that are mine.*

(Note: The definite article is omitted before possessive pronouns when the latter are preceded by éssere, *to be.*)

Da chi ricevete la vostra lana?	*From whom do you get your wool?*
E il tocco *or* un'ora.	*It is one o'clock.*
Oggi a otto o a quíndici, saremo di ritorno.	*To-day week or fortnight we shall be back.*

(The Latin method of including the first and last days of the period makes it really 8 and 15 days when speaking of a week or a fortnight.)

Meglio sarebbe darvi due libbre e mezzo di caffè.	*It would be better to give you 2½ lb. of coffee.*

(Note that **mezzo** is invariable when it follows the noun.)

Comparison of Adjectives and Adverbs.—These may be classified into three groups.

Equality
così . . . *come, as* . . . *as, so* . . . *as.*
tanto (i, a, e) . . . quanto (i, a, e), *as* . . . *as.*

Superiority
più . . . di, *more* . . . *than.*

Inferiority
meno . . . di, *less* . . . *than.*

Before an adjective (except a numeral, which always requires **di**), a verb or an adverb, **che** usually takes the place of **di** for *than*, as : **Siete più fortunato che prudente,** *You are more fortunate than prudent.*

The adjective usually follows the noun in

exclamations and in the comparative and superlative degree.

Scrive così bene come voi.	*He writes as well as you.*
Ho tanti libri quante etichette.	*I have as many books as tickets.*
Che balla grande !	*What a big bale !*

Di or **che** may sometimes be used indiscriminately for *than*, e.g. **Giovanni è più ábile di** (or **che**) **Giuseppe,** *John is more clever than Joseph.*

Superlative Degree.

By prefixing the definite article to the comparative adjective, or to the noun when followed by the adjective, we obtain the superlative degree.

Sono i più ricchi cittadini di Roma.	*They are the richest citizens in Rome.*

After a superlative, the preposition **di** is used instead of **in** before names of places.

By repeating an adjective or adverb, or by changing the last vowel of an adjective into **-íssimo**, we obtain the absolute Superlative, equivalent to *very* before the corresponding adjective or adverb.

Quest'uomo è póvero póvero (= poveríssimo).	*This man is very poor.*
Parlárono pian piano	*They spoke very softly.*
Questa città è salubérrima	*This city is very healthy.*

Instead of the **-íssimo** ending, a few adjectives end in **-érrimo**, as : **acre**, *bitter*, **acérrimo** *very bitter ;* **célebre,** *celebrated*, **celebérrimo ; intégro** (or **íntegro**), *honest* or *entire*, **integérrimo ; mísero,** *miserable*, **misérrimo ; salubre,** *healthy*, **salubérrimo.**

Voi parlate più che non pensate: siete il più gran ciarlatore del mondo.	*You speak more than you think ; you are the greatest chatterer in the world.*

Than between two verbs is often rendered by **che non.**

VOCABULARY

stante, *standing, in view of.*
la stabilità, *stability.*
proprio, *properly, really.*
tassativo, *definite, fixed, binding.*
la cagione, *cause, account.*
lo sbalzo, *leap, jump.*
subire, *to suffer.*
lieve, *light* (in weight), *slight.*
la costruzione, *construction.*
sensíbile, *sensible, considerable.*
la materia prima, *raw material.*
la mano d'opera, *workers, hands, employees.*
abbisognante (necessario richiesto), *needed, required.*
la pianella, *slipper.*
pertanto, *therefore.*
lo schiarimento, *explanation.*
aderire, *to adhere, fall in with, agree.*
alquanto, *somewhat, rather.*
ripréndere, *to resume.*
esagerare, *to exaggerate.*
la spesa, *expense, charge, cost.*
trasportare, *to transport, forward.*
divenire, diventare, *to become.*
il disastro, *disaster.*
per cúi, *consequently, for which reason.*
annullare, *to cancel.*
diversamente, differentemente, *differently.*
ingarbugliare, *to confuse.*
resi (réndere), *rendered, made.*
penoso, *troublesome, painful, difficult.*
la base, *base, basis.*
basare, *to base.*
la promessa, *promise.*
la richiesta, *request.*
davvero, *really.*
la nóia, *nuisance.*
la lingua, *tongue, language.*
depositare, *to deposit.*
tale quale, *just as.*
attivo, *active.*
il colore, *colour.*
chiaro, *light, clear.*
vendíbile, *saleable.*
scuro, *dark.*
l'imballaggio (*m.*), *packing.*
speditamente, *quickly.*
malgrado, *in spite of.*
esplícito, *explicit.*
spiccare, *to draw* (a draft).
il cárico, *charge.*

Exercise 31

Translate into English :—

1. I prezzi segnátivi poi, stante la poca stabilità del mercato metallúrgico, non sono proprio tassativi. 2. Nell'anno millenovecentodiciotto terminò la guerra. 3. A cagione dei contínui sbalzi die cambi, i prezzi póssono subire qualche lieve variazione. 4. Tremilacentuna o tremilacentotto balle di lana sono arrivate. 5. Se, durante la costruzione, noi avremo sensibili aumenti o diminuzioni tanto nelle materie prime che nella mano d'ópera, i prezzi aumenteranno. 6. Il secondo mese dell'anno è febbráio. 7. Vi abbiamo segnato tutto l'impianto abbisognante per una produzione di pianelle. 8. Comínciano a lavorare il lunedì e finíscono il sábato. 9. Potete quindi scégliere quelle mácchine che vi póssono interessare e che ancora non possedete. 10. Che ore sono ? (*Or* : Che ora è ? *Or* : Che ora abbiamo ?)

Exercise 32

Translate into Italian :—

1. As you see, differently from what you promised, you have confused the matter and made it still more difficult for me. 2. It will soon be five minutes past four. 3. Availing myself of (basing myself on) your promise, I ought to have requested that the draft should be in my name. 4. It was half-past ten or a quarter to eleven. 5. Although it may be so, I have accepted the draft in order not to create delay (pl.). 6. You have as many books as we. 7. Supposing that the goods have arrived in the last few days at Venice, I have agreed at once to the request of the Credito Italiano, in order to put an end to this matter. 8. He is not so good as his brother. 9. This matter has really become a nuisance for me. 10. Speaking (Tr : The to speak) a foreign language is more difficult than I thought.

Key to Exercise 29

1. He has read twenty-one chapters and I have read thirty-one. 2. Your letter of 4th instant enclosed invoice of the shipment made recently to your firm, together with an order for 600 pieces of drills at 7d. per metre ; we thank you very much for same. 3. Before going into a room, one must always knock at the door. 4. On leaving, they said good-bye to all their relatives and friends and promised to return as soon as they have the means to live without working. 5. After having written to my father, I took my letter to post and put it in a neighbouring letter-box. 6. It is certain that they will suffer losses if they sell the goods to the firms you mention. 7. Immediately the water boils, you must make haste, for I prefer to drink the tea very hot. 8. They have asked us to post our letters at once, and to reply always by return of post.

A. C.

SPANISH.—XVII

Modern Orthography. — By the latest decision of the Spanish Academy, monosyllables do not take any accent. Thus we now see **a**, **o**, **u**, **e**, **pie**, etc., without accent. Words like **más**, *more*, **dé**, *give* (subjunctive or imperative), retain the accent for distinguishing purposes, as otherwise unaccented **mas**, **de**, mean *but* and *of* respectively.

Adjectives — Superlative Absolute.— To form the absolute Superlatives the following changes are made in the endings of adjectives: the **c** in **-co** becomes **qu**; **g** in **-go** becomes **gu**; **-z** changes into **c**; **-io** is dropped, as **rico, riquísimo**, *very rich;* **amargo, amarguísimo**, *very bitter;* **feliz, felicísimo**, *very happy;* **amplio, amplísimo**, *most ample;* **necesario, necesarísimo**, *very necessary.*

Exceptions are: **frío, friísimo**, *very cold;* **agrio, agriísimo**, *very sour, acid;* **pío, piísimo**, *very pious.* Other irregular formations are adjectives ending in **ere, gro, bre**, which drop the last two letters and substitute **errimo**, as **acre, acérrimo**, *most acid;* **íntegro, integérrimo**, *most* (very) *integral or entire;* **salubre, salubérrimo**, *very healthful.* **Mísero** and others in **-ero**, take **érrimo** after dropping the ending **-ero**, as **misérrimo**, *most miserable*, etc. There are also some rarer irregular forms of the Superlative Absolute, derived from the Latin, but they are of little use for commercial purposes, and therefore omitted here.

Contractions in Adjectives.—Immediately before a masculine noun in the singular the adjectives **bueno, malo, alguno, ninguno**, and the article **uno**, drop the final **o**. The **to** ending of the adjective **santo**, *saint*, is dropped before the name of a saint, with few exceptions.

Plural of Nouns.—A noun ending in **s**, and not having the accent on the last syllable, remains unchanged in the plural, as: **el paraguas**, *umbrella*, **los paraguas**; **el lunes**, *Monday*, **los lunes.**

Augmentatives and Diminutives.— Nouns form the augmentatives by the addition of **on** (m.), **ona** (f.), etc., and diminutives by adding **-ico**, **-ito** for diminution and sometimes endearment; **illo, uelo**, for diminution and disdain. The ending **o** becomes **a** in the feminine, and the last letter of the adjective, if a vowel, is generally elided. These endings are sometimes preceded by **c** or **z**, **ec**, **ecec**, or **ecez**, as pie, piececito, piececico, piececillo, piecezuelo.

Adverbs.—Some adverbs are formed by adding MENTE to the feminine adjective, as **rigorosa** (f.), *rigorous*, **rigorosamente.** This suffix is only used on the last adverb, if two or more adverbs in **mente** occur in the same sentence.

Prepositions.—In Spanish, as in English, prepositions are always followed by the accusative case, as **para el**, *for him*, **por mi**, *by me.* **Para** and **por** are easily confused. It should be observed that **para** means *for, in order to*, and denotes the purpose, destination, or intention, whilst **por** signifies *through, by, for, out of, on account of*, and rather denotes the motive, cause, or reason.

Interjections are simply exclamatory words as: **Caramba!** *Goodness! Well, I never!* **Ojalá!** *God grant! Would that!* **Ojalá que sea así!** *Grant that it be so!* **Chito!** *Silence, hush!*

The last four parts of speech, Adverbs, Prepositions, Conjunctions, and Interjections, are invariable and therefore are more easily learned by practice.

Proverbs

El ejercicio hace maestro.	*Practice makes perfect.*
Cuando te dieren el anillo, pon el dedillo.	*Never allow a favourable opportunity to escape.*
El que tarde llega caldo bebe *or* camarón que se duerme se lo lleva la corriente.	*First come, first served.*
Cuanto mayor es la fortuna, tanto menos es segura	*When fortune is the most exalted it is the least secure.*
Debajo de una mala capa se encuentra un buen bebedor.	*Never judge from appearances.*

VOCABULARY

defectuoso, *defective, jobs.*	el accidente, *the accident.*
buen éxito, *success.*	el incendio, *fire, conflagration.*
fidedigno, *trustworthy, reliable.*	la especie, *kind, sort.*
escuchar, *to listen.*	tener (buen) éxito, *to be successful.*
callar, *to be silent.*	ensanchar, *to widen, enlarge, increase.*
la consignación, *consignment.*	hace (*it makes*), *ago.*
de costumbre (f.), acostumbrado, *usual.*	sinceramente, *sincerely.*
quidarse sentado, *to remain seated.*	la oficina, *office, counting-house.*
el telegrama, el cablegrama, *wire, telegram, cable.*	luego que, *as soon as.*
con arreglo a, *with due regard to, in conformity with.*	nada más, *nothing else.*
en tiempo oportuno, *in due course.*	la honra, *honour.*
	por mucho (poco, etc.), *however much (little,* etc.).
	dondequiera que, *wherever*
	disponer de, *to dispose of.*
	hasta, *even.*

Exercise 31

Translate into English:—

1. Tendremos relaciones comerciales con esas casas riquísimas. 2. Hemos mandado hoy veinte y una cajas de paraguas. 3. Después de haber examinado la muestrita que nos enviaron Vs., nos hemos decidido

a pedirles siete u ocho fardos de esta tela. 4. La casa González e Hijo ha siempre ejecutado nuestros pedidos al pie de la letra. 5. Tengan Vs. a bien el operar la venta de las mercancías con arreglo a mis mejores intereses. 6. Aconsejamos a Vs. que se lo digan a ellos de un modo que no pueda ofenderles. 7. Hay cien personas en esta sala, yo no quepo aquí. No cupieron tantas personas en la sala la semana pasada. 8. No sé porque se ofende de cualquier cosa qui se le diga.

Exercise 32

1. On (los) Mondays and Fridays we receive consignments of umbrellas. 2. Our friends, Messrs. Moreno and Sons, have not executed this order with their usual care. 3. They advised us to go to Madrid before our customer left for South America. 4. All these pieces will not go into one single case. 5. I did my best to deliver the goods in due course, but I could not, owing to a fire or an accident of some kind at the manufacturer's. 6. If they are successful, they will do their best to increase their connections.

Key to Exercise 26

1. Todo lo proveniente de la casa Jackson y Cía, está muy acreditado (goza de muy buena reputación en esta plaza). 2. Obedientes á las leyes de un buen gobierno, los habitantes de este país han prosperado mucho en sus operaciones comerciales. 3. ¿ Qué dijeron cuando le dieron á V. la carta ? 4. Condujimos á nuestro cliente hasta los almacenes de varios fabricantes, y le enseñamos todo lo que hubo de nuevo respecto á dibujos en la plaza. 5. Pongan Vs. en juego todos sus esfuerzos para dar pronto desempeño á nuestro pedido. 6. Pusimos en la factura los pesos netos (líquidos) y brutos de los bultos, cuando hicimos el envío. 7. Si yo hiciera un arreglo con él le pondría V. un cable el mismo día. 8. Hágale V. presente que no estoy pronto á apoyar á su amigo de él en conducta tan escandalosa. 9. Fueron las únicas personas que fuimos á ver en este particular. 10. Satisfázanos V. á vuelta de correo ó haremos protestar la letra y V. tendrá que soportar los gastos y todas las consecuencias.

Key to Exercise 27

1. To-day is the 21st May, 1919. 2. London, October 15th, 1899. 3. The days of the week are : Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday. 4. Tell me the months of the year. 5. The months, in successive order, are : January, February, March, April, May, June, July, August, September, October, November and December. 6. There are four seasons in the year. 7. The names of the seasons are : Spring, Summer, Autumn, and Winter. 8. Come to see me at a quarter to two. 9. It is twenty-five minutes past one ; I must go. 10. We shall begin the work at a few minutes to nine in the morning. 11. Now the cardinal numbers are used nearly always instead of the ordinals, after the tenth or twelfth at the most. 12. This is done on account of the extreme length of the ordinal numbers. 13. He presented himself at my office at five minutes to twelve. 14. If you come here at a quarter past eleven or at half-past one, I shall be at your entire disposal. 15. I came out of the theatre at twenty to eleven and arrived home at midnight. 16. There are sixty seconds in a minute and sixty minutes in an hour. 17. From sunset until midnight is the night, and from midnight until sunrise is called early morning. 18. They got up at three o'clock in the early morning and arrived at their destination at half-past eight in the morning. 19. When it strikes three in the afternoon, that is to say, at three o'clock precisely, you must be with me. 20. What day of the month is it to-day ? It is the ninth and to-day is my birthday.

Key to Exercise 28

1. ¿ A cuantos del mes estamos hoy ? Estamos al primero de diciembre. 2. El primer día es jueves y el tercer día es sábado. 3. La primera de las cajas está marcada como el primer fardo. 4. Hemos pedido ciem piezas, pero han enviado ciento cinco. 5. El capital de la Compañía es cien mil libras esterlinas al presente, pero se aumentará hasta doscientos mil libras. 6. Se dice que Francia ha recibido cien millones de libras esterlinas de las cinco mil millones de libras esterlinas fijadas como indemnidad. 7. Les remitiremos cuatrocientas libras esterlinas durante el primer semestre, y quinientas libras esterlinas mensualmente después. 8. Liverpool, el veinte y uno de noviembre de mil novecientos veinte. 9. Sírvase V. decirme los días de la semana y los meses del año. 10. Son : lunes, martes, miércoles, jueves, viernes, sábado, domingo ; y : enero, febrero, marzo, abril, mayo, junio, julio, agosto, setiembre, octubre, noviembre, diciembre. 11. Escríbame V. las cuatro estaciones que hay en el año. 12. Jorge quinto, Rey de Inglaterra y Emperador de la India. 13. Louis once reinaba sobre Francia. 14. Después del décimo, los números cardinales se emplean generalmente en lugar de los ordinales. 15. Esto es preferible por motivo de la largura de los números ordinales. 16. ¿ Se ha presentado en su despacho antes ó después de has doce ? 17. Venga V. á las tres y cuarto de la tarde. 18. Estaré pronto á la una en punto. 19. Espero estar consigo cuando dé la una.

Key to Exercise 29

1. The half of the order will not be executed. 2. We want payment in advance for the third part of the invoice. 3. The article must not come out at $5\frac{3}{8}$ per yard. 4. We have bought about thirty cases of this same quality. 5. I do not know how old he is, but it will be about 30 to 32. 6. To-day is the 22nd April, 1920. 7. Tell me how old you are. 8. How old is your partner ? 9. Nowadays there is absolutely no business with Petrograd. 10. We have never seen prettier (nicer) designs than these. 11. The goods we have received are worse than those of last year. 12. He passes (spends) most days doing nothing. 13. The greater part of these grey cloths are full of faults. 14. They are also inferior to the pattern. 15. The invoice called "rectified" contains as many mistakes as the original had (as were in the original one). 16. The maximum amount stated must not be exceeded. 17. That is less than (what) I thought.

Key to Exercise 30

1. No sé todavía (aún) si puedo ejecutar la mitad o sólo el tercero (la tercera parte) de su pedido. 2. La calidad que quiero no debe (deberá) salir á más que (or de) dos chelines y tres peniques el metro. 3. Han tenido que devolver veinte de las peores piezas (piezas peores) al fabricante. 4. ¿ Cuál es su edad de V. ? or ¿ Cuántos años tiene V. ? or ¿ Qué edad tiene V. ? 5. Tengo treinta y cinco años hoy, que es mi cumpleaños. 6. Hoy día los precios están tan altos que casi es imposible (el) vivir. 7. Nunca he visto géneros (mercancías, mercaderías) más caros que estos. 8. Juan es el menor de los tres hermanos, pero es el más alto (grande). 9. Es el muchacho más alto que yo conozca. 10. Lo más que podamos hacer es mil piezas. 11. Hay menos de una centena de piezas en cada fardo. 12. Por desgracia (Desgraciadamente) es lo más que podamos ofrecerles á ellos. 13. El mayor y el menor de los hermanos son socios en la misma casa. 14. Tenemos menos de cincuenta y cinco cajas en aquel vapor y no más que quinientas en éste. 15. Nuestras calidades son mejores de lo que parecen.

A. C.

Continued from page 231.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

BRITISH ISLES.—III

THE British Isles enjoy a more equable climate than the contiguous continent of Europe owing to their insular position. The prevailing winds being from the south-west (anti-trades), passing over large expanses of ocean, cause the temperature to be higher in winter and cooler in summer than that of continental districts of the same latitude. The difference of average temperature between the warmest and coldest months is only 26° Fahr.

Our Wonderful Climate

Generally speaking the west coast is much warmer than the east, and this is especially the case in Scotland where the isotherms for the year run in an almost exactly north and south direction. At the same time, owing to the fact that the west of the islands consists of higher ground than the east, more rain falls in the former. The rainfall naturally varies with the heights of the land and other physical features as explained in Vol. II., page 162. In the Stye Head Pass in Cumberland it reaches an average of 186 inches a year, whereas over nearly half of England it is less than 30 inches, the average for the year in London being about 24 inches.

Generally the climate is extremely healthy and equable, the temperature is remarkably high, especially in winter for the latitude, and the rainfall, fairly well distributed throughout the year, is enough for vegetable growth.

The British Isles consist of six divisions, viz. England, Scotland, Wales, Ireland, the Isle of Man and the Channel Islands. The four former divisions are subdivided into counties (in Ireland these are grouped into four provinces). The Isle of Man has a separate legislature—the House of Keys, and is not affected by acts of the British Parliament unless expressly mentioned. The Channel Islands are divided into two Bailiwicks of Jersey and Guernsey.

There are 40 geographical counties in England, 12 in Wales, 33 in Scotland and 32 in Ireland. Politically, however, England consists of 50 counties, some of the larger cities such as London, York, etc., being constituted as counties themselves. Apart from these latter the size of the counties varies very greatly from Rutland with an area of 170 square miles to Yorkshire with over 5,800 square miles. In many cases the counties have boundaries marked by no definite physical features, and in some cases, especially the midland counties of England, a portion of one county is actually surrounded, as would be an island, entirely by another, portions of Warwickshire, for instance, being enclosed in Gloucestershire.

County Towns

Each county has a county town, which forms the administrative centre of the county and where, if sufficiently important, the courts of assize are held, though in many cases these are also held in other large centres which may not be county towns, such as Liverpool and Birmingham.

In considering in greater detail the physical and economic constitution of the British Isles, we will group together the various counties according to their natural characteristics and peculiarities, and for this purpose will commence with Scotland and work upwards in a southerly direction.

The Shetlands form a group of some 100 islands lying about 50 miles north-east of the Orkneys, with which for administrative purposes they are grouped. The island of Mainland is the largest and forms about half the area of the entire group containing the capital town of Lerwick. About 30 of the islands are inhabited. Although the average height of the islands is only about 500 feet Mainland rises to nearly 1,500 feet in Ronas Hill. The coast is very rugged and indented, cliffs rising in places to over 1,000 feet in height. Very little of the soil is capable of cultivation, the chief industries being fishing

and the breeding of the famous Shetland ponies and sheep — Shetland wool being very well known. The rocks comprising the group are of the same crystalline series as those of the Highlands of Scotland.

The Orkney Islands are separated from the north-east coast of Scotland by the Pentland Firth, about six to eight miles broad. Most of them are low though Hoy attains a height of nearly 1,600 feet and has precipitous cliffs in the west. The rocks are of the Old Red Sandstone series and have been carved out into isolated rock pillars or " stacks " ; one of these, " The Old Man of Hoy," is 450 feet high. About 30 of the islands are inhabited, the largest, Pomona or Mainland, containing the capital town, Kirkwall. Agriculture, fishing and wool are the chief industries. The Orkneys and Shetlands together return one member to parliament, the population of the two groups being over 50,000. The open roadstead of Scapa Flow between the islands of Pomona, Hoy and South Ronaldshay was the headquarters of the Grand Fleet during the Great War of 1914-18.

The Highlands

The most northerly of the highland counties are Sutherland, Ross and Cromarty and Caithness. The former consist of ancient crystalline rocks of great age and are mainly barren moorland and rugged mountains with lakes, waterfalls and deer-forests. The eastern part of these counties and the whole of Caithness is composed of the Old Red Sandstone rocks and is lower in altitude and capable of cultivation. Thurso, in Caithness, is the most northerly port of Great Britain ; in the extreme north, near to Duncansby Head, formerly stood John o' Groats' house, the most northerly inhabited house in Great Britain, but there are no remains of it left. Flagstones are quarried at Thurso.

South of these counties is the great county of Inverness stretching from the Moray Firth in the east to the Sound of Sleat on the west. Included in Inverness are also the Inner Hebrides Islands and the Outer Hebrides with the exception of Lewis (the northern part of the island of Harris and Lewis which belongs to Ross and Cromarty). Inverness is a county of lofty mountains with magnificent glens and lakes. It is crossed in a diagonal direction from north-east to south-west by Glenmore (the great glen), through which passes the Caledonian Canal formed by joining up a series of lakes, Loch Ness, Loch Lochy, etc. The county town is Inverness, situated near the north end of the canal, and near to it was fought the battle of Culloden Moor in 1746. The county contains towards its south-western extremity Ben Nevis, the highest mountain in the British Isles, 4,406 feet high. The Outer Hebrides are separated from the mainland and from the Inner Hebrides by The Minch and Little Minch. They consist of one large island called Lewis in the north and Harris in the south. The other islands are North and South Uist, Benbecula, Barra and many smaller islets. They are all more or less barren though cultivated in parts, and they contain many lakes.

Fingal's Cave

The Inner Hebrides consist of two large islands, Skye and Mull, the latter of which forms part of the county of Argyll, and a number of smaller islands and islets. Many of these are covered with a thick layer of basalt forming terraces often showing columnar structure. Fingal's Cave in the island of Staffa is formed in this rock where the sea has eroded a cavern 200 feet long and 60 feet high. Skye is mostly barren and contains a range of very rugged mountains known as the Cuillin Hills.

The counties of Nairn, Elgin, Banff, Aberdeen and Kincardine are usually considered as part of the Highlands. They are all mainly moorland and mountain except on the coast where the Old Red Sandstone formation forms a borderland of lower elevation. Aberdeen, the largest of them, has some of the highest mountains in Britain, such as Ben MacDhui, 4,296 feet high, one of the Grampian Mountains. The capital of the county is Aberdeen, a fine town built of grey granite and containing a university. In the south-west of the county on the river Dee is Balmoral, one of the royal residences most picturesquely situated. Peterhead, north of Aberdeen, is a small seaport and is a centre for the Greenland whale fisheries. It is built of red granite which is largely quarried in the district.

To the south of the highland counties and intermediate between them and the lowland plain are the counties of Forfar, Perth, Stirling, Dumbarton and Argyll. In Forfar and Perth is the valley of Strathmore forming part of the basin of the Isla and the Tay. It is a fertile valley bounded on both sides by igneous and crystalline rocks. In Forfarshire is Dundee, a seaport on the Firth of Tay, manufacturing sacking from jute, ropes and coarse linen. Shipbuilding is also carried on to a large extent and there are

Drawn by W. B. Robinson.

OUR WONDERFUL CLIMATE.

A map based on the result of some 3,000 records, covering the period of one year, showing the wet and dry parts of the British Isles.

large confectionery, jam and marmalade manufactories. A great part of Perthshire is reckoned as in the Highlands, and it contains magnificent scenery of mountains, woods, valleys, lakes and waterfalls. Near the town of Perth is Scone, the ancient crowning place of the Scottish kings; the stone on which they used to sit now forms part of the coronation chair in Westminster Abbey. In the town of Perth a dyeing industry has developed owing to the purity of the water in the district.

Loch Lomond

Like Perthshire, Stirlingshire also is partly in the Highlands, the eastern shore of Loch Lomond forming its western boundary. Much of the scenery is very picturesque, but a considerable portion of the county is fertile and well cultivated. Stirling on the river Forth is the capital town, and it has a celebrated castle affording magnificent views of the country westward to Ben Lomond, and eastward by the windings of the Forth. Falkirk and Bannockburn, where battles were fought, owed their importance to their strategic position on the narrow neck of Scotland between the rivers Forth and Clyde.

The Carron Ironworks, near Falkirk, are well known for the manufacture of engineering ironwork and domestic supplies, the latter including grates and stoves. Facility of transport to the North Sea, and to the Atlantic through Clyde ports, is provided by the Forth and Clyde Canal (opened 1790). This short but invaluable waterway starts at Bowling, on the Clyde, and connects with the Forth at Grangemouth.

In Dumbartonshire is the greater part of Loch Lomond, and the northern parts contain high and lofty mountains and much beautiful scenery. The county town of Dumbarton has a castle, once a fortress of great strength, situated on the Clyde. It is now an important shipbuilding port with large engineering works.

Argyllshire includes about 40 of the Inner Hebrides and is mostly rugged and mountainous, with much wild scenery, especially in the north and east. Bordering on Inverness is the Pass of Glencoe, made famous by the massacre, in 1692, of the Clan Macdonald by the Government troops. On the coasts are the well-known watering places of Oban, Dunoon and many others on the Firth of Clyde with its numerous inlets. On the islands of Iona, to the west of Mull, are the ruins of a beautiful cathedral built on the site of an ancient monastery founded in the sixth century by St. Columba. The fisheries of the county employ a considerable number of the inhabitants, and there are valuable quarries of marble, stone and slate.

The Lowland plain of Scotland is, as we have seen above, a rift valley in which the newer rocks have been "let down" between faults in the older formations. The greater part of these rocks are of the Carboniferous series and are rich in coal, and, as the district is also very fertile, the population is dense.

On the Lowland plain is Edinburgh, the capital of Scotland, by the Firth of Forth, a city which has grown up round the Castle which crowns a rocky crag guarding the gap between the Pentland Hills and the sea.

Historic Edinburgh

Edinburgh is one of the most beautiful cities of the British Isles and possesses many buildings of great historical interest including the Castle and Holyrood Palace. The University is noted for its medical school, and besides this there are many public and endowed schools. Printing and publishing are important trades of Edinburgh, and there are other manufactures such as india-rubber, gutta-percha, brewing, etc. Near Edinburgh the Forth is spanned by a huge cantilever bridge, at the time of its erection considered one of the engineering wonders of the world. The bridge connects the counties of Linlithgow and Fife.

At Linlithgow, the capital of the county of the same name, is a palace of historical interest where was born Mary Queen of Scots.

In the county of Fife, on the shore of the Forth, is the new large naval base of Rosyth. During the Great War (1914–1918) a pipe-line was laid between the Clyde and Forth for the purpose of conveying oil direct from tankers to the warships at the naval base at Rosyth.

There is an important coal-field in the south of the county, and this has helped to establish a linen industry in Dunfermline and the manufacture of linoleum at Kirkcaldy. St. Andrews, on the North Sea coast, is noted for its University and its golf-links, the town being considered the headquarters of the game of golf throughout the world, wherever played.

Towards the western side of the Lowland plain is the county of Lanark, which includes Glasgow, the second largest city of the United Kingdom, within its borders. Glasgow is situated on the Clyde, at a position which in bygone days was the lowest on the river that it was convenient to bridge. Many years ago the Clyde was deepened to allow large vessels to reach Glasgow, and with that

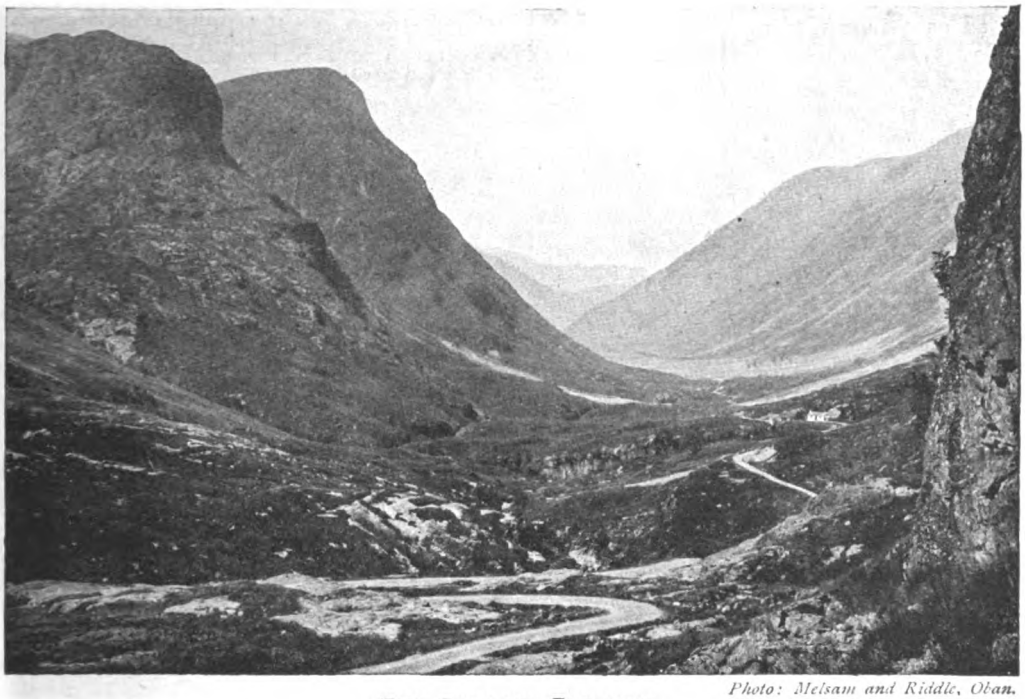


Photo: Melsam and Riddle, Oban.

THE PASS OF GLENCOE,

the scene of the massacre (1692) of the Clan Macdonald, a massacre which must always remain a dark stain on the Government of William III.

BEN NEVIS (4,406 feet),

in the south-west corner of the county of Inverness, is the highest mountain in the British Isles.

improvement the town has enormously increased as a port trading with America and the West Indies, etc., and as a centre of the steel shipbuilding industry. There are also important manufactures of machinery, chemical works, etc. The population of Glasgow is now considerably over a million.

On both sides of the Clyde, in the counties of Dumbarton and Renfrew, are manufacturing towns employed in shipbuilding and other industries. In Lanarkshire are the towns of Airdrie, Motherwell, Coatbridge and Hamilton, all possessing large coal mines and ironworks. Indeed the whole district is almost one huge industrial centre sprung up from the natural products of the region, namely, coal, iron and oil-shale.

In Renfrewshire the manufacturing district of the east is a continuation of the Glasgow district, and at Paisley there are extensive manufactories of thread, shawls and woollens. Greenock, on the Clyde, is noted for sugar refining.

Ayrshire, also for the most part on the Lowland plain, is the chief dairy county of Scotland. The capital of the county is Ayr, a small seaport on the river of the same name. Burns's birthplace is close by, and it is in this district that Wallace's early exploits took place. The southern part of the county belongs, physically speaking, to the southern uplands.

In the Tweed Valley

To the south of the Lowland plain of Scotland are the southern uplands, a hilly though hardly mountainous region of ancient sedimentary rocks consisting of limestones, sandstones and shales of the Ordovician, Silurian, etc., ages. They are mainly covered with coarse grass and heath and are largely a grazing ground for sheep, the wool of which has established the woollen industry in the Tweed valley. "Tweeds," as the manufactured woollens are called, are made at Peebles, Innerleithen, Walkerburn, Galashiels, Hawick, Selkirk, Jedburgh, etc.

Many parts of the uplands, especially in the valleys, such as those of the Tweed and its tributaries, and also the coastal plains of Ayrshire, Wigtown and Kirkcudbright, are very fertile, the latter districts especially being noted for their cattle and dairy produce.

From Port Patrick, in Wigtownshire, to Donaghadee, in Ireland, is only just over 20 miles, and a short steamer route between the two countries runs from Stranraer, at the head of Loch Ryan, to Larne.

Tweed valley before-mentioned, and Jed, are interesting for the ruined abbeys forming the picturesque piles of Melrose, Dryburgh, Jedburgh and Kelso, and also for association with Sir Walter Scott, whose house at Abbotsford is near the junction of the Tweed and the Gala.

The boundary line between Scotland and England runs at first north of the Tweed, encircling, in England, the town of Berwick-on-Tweed. It then follows the line of the river to a little beyond Coldstream, and after this takes the line of the Cheviot Hills. At the end of the Cheviots the boundary crosses the level ground of the Solway Moss to the Solway Firth.

For detailed consideration England is not so conveniently divided as Scotland across well defined, more or less easterly and westerly lines, and a physical division of the country corresponding to the watersheds will be followed.

The Cheviot Hills

First of all, then, we have in the north the Border, abutting on the Cheviot Hills, and prolonged southward right into Derbyshire in the long watershed of the Pennine Chain.

The Cheviot region consists of an upland district mostly in the western and north-western portion of the county of Northumberland. It is of a moorland nature; in the higher parts the rocks are of an igneous character, rising in the case of the Great Cheviot to over 2,600 feet high, and the country generally consists of rounded and grassy slopes used mostly as pasturage for sheep.

Between the Cheviots and the Pennine Chain is the deep valley through which flows the South Tyne, and on the north side of this valley was built the Great Wall by the Roman Emperor Hadrian, much of which is still in existence. The valley is now occupied by the railway from Newcastle to Carlisle, from which, near Hexham, a branch follows the valley of the North Tyne over the watershed into Scotland. Hexham, a small town, once the seat of a bishop, has interesting ruins of a priory.

Southward from this valley for some 120 miles extends the Pennine Chain, though it is cut through by the valleys of the Aire and Ribble in the neighbourhood of Skipton. In parts it is as much as 40 miles wide; it formerly acted as a very real barrier between the eastern and western districts on either side. Even now the railways cross it at comparatively few points. The moors separating the valleys from each other are noted resorts for sportsmen. C. J. S.

Continued from page 240.

MATHEMATICS:

Contributor: — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.

(M. A. Lewenz, M.A.[Lond.]).

HYDROSTATICS.—II

13. If two vessels containing the same liquid are connected by a pipe, then if the surface level of the liquid in A be higher than that in B, the liquid will flow through the pipe P from A into B.

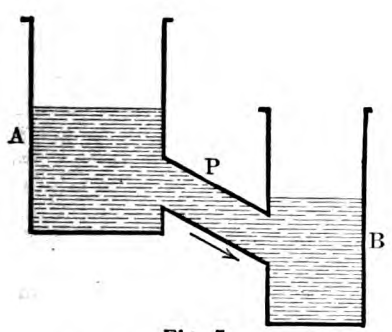


Fig. 7.

This we should expect, for if we consider the pressure on a section of P, we see that the pressure on the face of the section turned to A is higher than that on the face of the section turned to B, for the section is at a greater depth below the free surface of A than below the free surface of B, and pressure varies with the depth. Consequently there is a flow from A to B. When the free surfaces in A and B are at the same level, the pressure on either side of a section of P is the same, and hence the flow ceases and the liquid comes to rest.

We see therefore that a liquid always flows from a higher to a lower surface level, and if the liquid is at rest, i.e. in equilibrium, the surface level must be uniform. In other words the free surface of a liquid in equilibrium is horizontal, or rather every portion of it is at the same distance from the centre of the earth. When we have a large surface, like that of a very large lake, we find the surface slightly curved, but this curvature is very small.

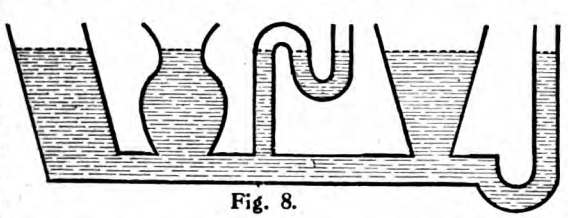


Fig. 8.

We may show experimentally that *the surface of a liquid at rest rises everywhere to the same level.* Take several vessels of different shapes and sizes, all connected by pipes with one another, and pour water into any one of them. It will rise to the same level in all. This principle is made use of in supplying water to towns and so forth.

14. *When communicating vessels contain different liquids that do not mix, the height of their free surfaces above their surface of separation varies inversely as the specific weight of the liquids.*

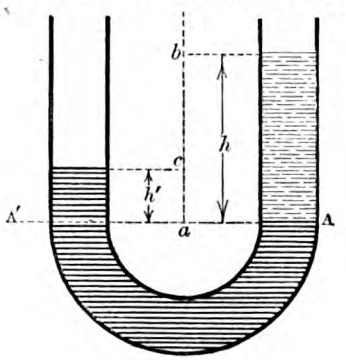


Fig. 9.

We may measure the specific weight of a liquid by the weight of unit volume.

Suppose a U tube to have two liquids that do not mix (say mercury and water) one in each arm.

Let A A′ be a horizontal line drawn through their surface of separation.

Let r be the area of a section of the tube.

Let $a\ b$, the height of the one column, $= h$.

Let $a\ c$, the height of the other column, $= h'$.

Let s and s' be the specific weights of the liquids.

Since the whole is in equilibrium, the pressures at A and A′ on the same horizontal level must be the same.

Now the pressure on A $= r \times h \times s$

and the pressure on A′ $= r \times h' \times s'$

$\therefore\ r\,h\,s = r\,h'\,s'\ \therefore\ h : h' = s' : s$

i.e. the heights of the columns vary inversely as the specific weights of the liquids.

15. *The pressure on the base of a vessel containing a liquid varies only with the area of the base, and the depth of that base below the surface, and is independent of the shape of the rest of the vessel.*

(i) If the sides of the vessel are vertical, the pressure on the base is clearly equal to the weight of the liquid in the vessel, and the horizontal pressures do not affect the pressure on the base.

(ii) If the sides of the vessel slant outwards.

Consider the cylinder A B E F. The weight of this mass of liquid is supported by the base; the pressure of the remaining ring of liquid on A B E F

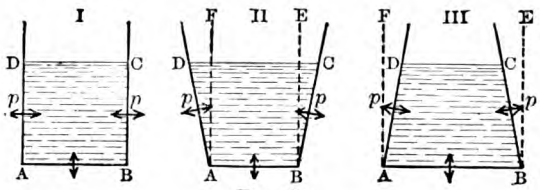


Fig. 10.

is horizontal and does not affect the pressure on the base. The weight of the outer ring of liquid is supported by the sides, for the reaction of the sides has an upward vertical component. Hence the pressure on the base equals the weight of the column of liquid standing on the base.

(iii) If the sides of the vessel slant inwards.

Here the reaction of the sides has a downward vertical component, which increases the pressure on the base. Since the pressure of the liquid on the sides would support the ring of liquid completing the cylinder A B E F (if the sides were removed), we see that the whole pressure on the base again equals the weight of a column of liquid standing on the base.

In (i) the pressure on the base equals the weight of the fluid.

In (ii) the pressure on the base is less than the weight of the fluid.

In (iii) the pressure on the base is greater than the weight of the fluid.

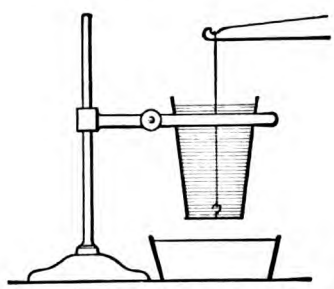


Fig. 11.—**To illustrate the use of Pascal vases.**

16. Pascal's Vases

The above may be verified experimentally in a manner invented by Pascal.

Take a number of vessels of different shapes, open at both ends, and having the opening at the bottom of the same size, so that it can be closed by a circular disk. Fix one vessel upright and close it by attaching one end of a string to the upper side of the disk, and the other end to one arm of a balance, to the other arm of which weights are attached.

Now pour water into the vessel. As soon as the weight of the water and that of the disk together exceed the weights on the balance the disk will fall off. By means of a scale you can measure the height of the water when this occurs. Repeat the experiment with the other vases, and you will find that in every case the water stands at the same height when the disk falls.

17. Pressure on an Immersed surface

Let A B C D E be any area immersed in a homogeneous fluid. Let $f\ g$ be an element of area so small that the intensity of pressure at all points in $f\ g$ is the same; let the depth of $f\ g$ below the surface be z. If s = weight of unit volume of the liquid and a = area of $f\ g$, then pressure on $f\ g$ $= a \times z \times s$.

The whole pressure on A B C D E is the sum of all the pressures vertically downward on the elements of area which make up A B C D E.

Hence the whole pressure

$$= a_1 z_1 s + a_2 z_2 s + a_3 z_3 s + \ldots\ldots$$
$$= (a_1 z_1 + a_2 z_2 + a_3 z_3 + \ldots)s$$

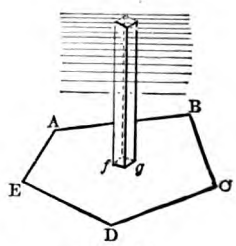


Fig. 12.

Now z the depth of the centre of gravity of the area

$$= \frac{a_1 z_1 + a_2 z_2 + a_3 z_3 + \ldots}{a_1 + a_2 + a_3 + \ldots}$$

Hence the whole pressure = A z s, where A = total area immersed.

Thus the whole pressure on any area immersed equals the weight of a column of liquid, having the area for base and the depth of its centre of gravity below the surface for height.

When a plane surface is immersed in a fluid, the pressures at different points are all normal to the surface and therefore all parallel to one another. They constitute a system of parallel forces of which the whole pressure is the resultant. The point at which this resultant would act is called the **centre of pressure.**

If a plane area is immersed horizontally the centre of pressure will clearly coincide with the centre of gravity of the area.

In any other position the two will not coincide, for as the pressure varies with the depth, the pressures on equal elements of area will not be equal.

Example.—Find the centre of pressure of a rectangular area immersed vertically with one side at the surface.

Let A B C D be the area immersed vertically having A B at the surface.

Let E F bisect A B and D C, then the pressure is

equally distributed on either side of the line E F, therefore the centre of pressure lies on E F.

Take the line G H, bisected at F, to represent the pressure at F.

Through any point P on E F draw K P L parallel to G H.

Since the pressure varies with the depth, pressure

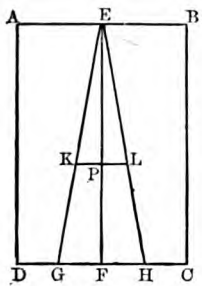


Fig. 13.

at P : pressure at F : : E P : E F : : K L : G H but G H represents the pressure at F

∴ K L represents the pressure at P.

Now the point at which the resultant of all the forces represented by G H, K L, etc., acts, is the centre of gravity of the triangle E G H, i.e. it is the point O on E F where F O = $\frac{1}{3}$ F E.

Exercise 2

(1) A cubical block of edge 10 cm. is sunk in water so that two opposite faces are horizontal. Find the difference in pressure on these two faces. (1 cub. cm. of water weighs 1 grm.)

(2) Find the pressure on the bottom and sides of a cubical vessel of edge 10 cm. filled with mercury. (1 cub. cm. of mercury weighs 13·6 grms.)

(3) A cube whose edge is 5 cm. is immersed in mercury with two opposite faces horizontal, the upper being 18 cm. below the surface of the mercury. Find the pressure on the faces.

Immersed and partially immersed bodies.

18. If a body is immersed in a fluid we know that everywhere the pressure of the fluid on the body is normal to the surface presented to the fluid. We want to find what the resultant pressure on the body will be.

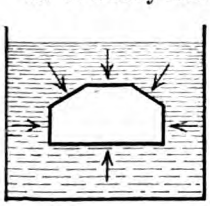


Fig 14.

Suppose the body to be replaced by a mass of the same shape of the fluid in which it is immersed. Then as the whole fluid is at rest, the mass of the fluid replacing the body will be in equilibrium. Hence the weight of this portion of fluid, which acts at its centre of gravity, must counterbalance the resultant pressure of the surrounding fluid; hence this resultant pressure must act vertically upwards through the centre of gravity of the portion of fluid and must equal its weight.

Now this portion of fluid is the fluid displaced by the solid, and their centres of gravity coincide. Also the pressure of the surrounding fluid is the same, whether it be exerted on the solid or on the portion of the fluid displaced by the solid. Hence we conclude that: *the resultant pressure on a solid immersed in a fluid is a pressure equal to the weight of the fluid displaced and acting vertically upwards through the centre of gravity of the solid.*

This point through which the resultant pressure acts is called the **centre of buoyancy.** It follows that if we weigh a body in air, and then in a fluid heavier than air, the body will weigh less under the latter conditions.

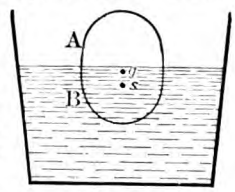


Fig. 15.

The above principle is known as the principle of Archimedes who discovered it, and is often stated as follows:—

A solid body immersed in a fluid loses a portion of its weight equal to the weight of the fluid displaced.

19. Floating bodies.

When the weight of a solid body is less than that of the liquid it displaces, the body will rise and float.

Consider a body floating in a fluid having a portion A above the surface and the rest B below the surface of the fluid.

The forces acting on the body are:—

(1) The weight w of the body acting vertically downwards at G, its centre of gravity.

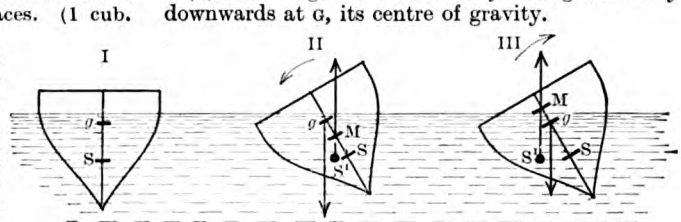


Fig. 16.—Explaining stable and unstable equilibrium.

(2) The resultant pressure of the fluid, which equals w the weight of the fluid displaced by the portion B and acting vertically upwards at S, the centre of buoyancy.

Since there is equilibrium w must equal w' and S must be in the same vertical straight line as g.

20. Stable and Unstable Equilibrium.

If the body be slightly displaced so that S and G do not lie in the same vertical line, the movement of the forces acting on the body may or may not tend to restore it to its original position. In the former case its equilibrium is stable, in the latter, unstable.

Consider a body which is in equilibrium (I).

Let it receive a small displacement. Then there will be a new centre of buoyancy S′. Let the vertical through S′ meet the original vertical through g and S at M. The point M is called the **metacentre.**

Now if M lies below g (II) then the movement of the forces will tend to overturn the body. But if M lies above g (III) they will tend to bring the body back to its original position. Hence a body

is in stable or unstable equilibrium according as its metacentre lies above or below its centre of gravity. Clearly if the centre of gravity lies below the centre of buoyancy, the equilibrium must be stable.

Exercise 3

(1) A cube of a substance whose specific weight is ·75 that of water and is floating in water, descends 1 inch when a weight of 2180 oz. is placed on it. Find the size of the cube.

(2) Find the force with which a sphere of radius 24 inches is urged upwards, if it is totally immersed in water.

(Volume of a sphere $= \frac{4}{3} \pi r^3$, $\pi = 3{\cdot}14159$.)

Key to Exercise 1

(1) 921 tons, 12 cwt.
(2) 2880 lb.
(3) 60 lb.

M. A. L.

MENSURATION.—III

25. *To find the area of a plane lune.*

If the ⊙s A B C, B D C cut at B and C, then the figure A B E C is a plane lune.

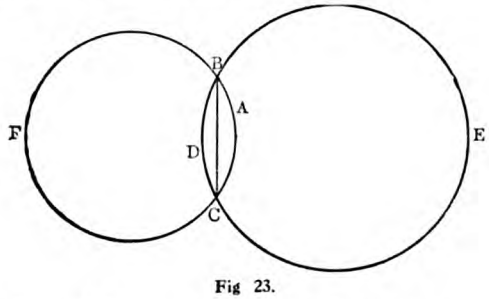


Fig 23.

Area of fig. A B E C = area of segment B E C — area of segment B A C.

These areas can be found as in § 18.

If L_1 and L_2 be the areas of the two lunes formed by the intersection of ⊙s A B C, D B C and the radii of these ⊙s be r_1 and r_2 respectively,

then L_1 = area of ⊙ A B C — area B A C D

L_2 = area of ⊙ D B C — area B A C D

$\therefore L_1 - L_2 = \pi r_1^2 - \pi r_2^2 = \pi (r_1^2 - r^2_2)$

26. We must now turn our attention to solid figures, and must deal with the geometry of these before finding their areas, volumes, etc.

It is very desirable that the student should make models of solid figures. These may be made of thin cardboard or else by means of wires and dried peas into which, when soaked, the wires may be stuck.

Definitions.

A **polyhedron** is a solid figure bounded by plane faces.

A **parallelepiped** is a solid figure bounded by 3 pairs of parallel plane faces (*see* Fig. 25).

The **edges,** being the lines of intersection of parallel planes with parallel planes, form three sets of parallel lines, four edges in each set.

The six FACES are parallelograms.

A **parallelepiped is rectangular** when each face is at right angles to the faces which it meets (*see* Fig. 26).

Each **edge** is perpendicular (or **normal**) to the face which it meets.

Each face is a **rectangle.**

A rectangular parallelepiped is often called a **rectangular block.**

A **cube** is a rectangular block in which all the edges are equal.

Each **face** of a cube is a square.

A **prism** is a solid figure bounded by any number of plane faces, of which two, called the **ends,** are **parallel** to each other, and the edges of the other faces are all parallel to the same straight line (*see* Fig. 24).

The ends are congruent triangles, quadrilaterals or polygons.

The other faces are parallelograms.

A **right prism** is one in which the ends are at right angles to the other faces.

The **sides** (i.e. the faces which are not the ends) are rectangles.

A parallelepiped is therefore a prism whose ends are parallelograms.

A **triangular prism** is one whose ends are triangles, i.e. it is a wedge whose ends are perpendicular to its edges.

A **pyramid** is a solid figure bounded by plane faces, of which one, called the **base,** is a triangle, quadrilateral or polygon, while the others are triangles meeting in a point called the **vertex** (*see* Fig. 27). The **height** of a pyramid is the length of the normal (or perpendicular) drawn from the vertex to the base.

A **tetrahedron** is a pyramid having a triangular base (*see* Fig. 30).

A **frustum of a pyramid** is the part between two planes parallel to the base.

27. *If a prism be cut by parallel planes, the sections are polygons which are congruent.*

Let the prism whose two ends are A B C D E and P Q R S T be cut by parallel planes and let two sections be *a b c d e* and *p q r s t.*

Then *a b* and *p q* are the intersections of these parallel planes with the plane A B Q P.

∴ Now *a b* and *p q* must be parallel, for if not they must meet.

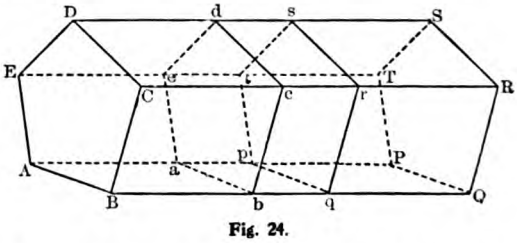


Fig. 24.

But *a b* lies wholly in plane *a b c d e* and *p q* lies wholly in *p q r s t.*

∴ these planes must meet if *a b* and *p q* meet, which is impossible.

Also A P and B Q, edges of the prism, are ∥

∴ *a b q p* is a rect.

∴ *a b* = *p q.*

Similarly $b\,c = q\,r$, $c\,d = r\,s$, $d\,e = s\,t$ and $e\,a = t\,p$.

Again $\because a\,b$ and $b\,c$ are equal and $\parallel$ to $p\,q$ and $q\,r$

$\therefore \angle a\,b\,c = \angle p\,q\,r$.

Similarly the other angles of $a\,b\,c\,d\,e$ are equal to those of $p\,q\,r\,s\,t$ respectively.

$\therefore a\,b\,c\,d\,e \equiv p\,q\,r\,s\,t$.

28. *The opposite faces of a parallelepiped are equal parallelograms, and any section by a plane which cuts any two pairs of opposite faces is a parallelogram.*

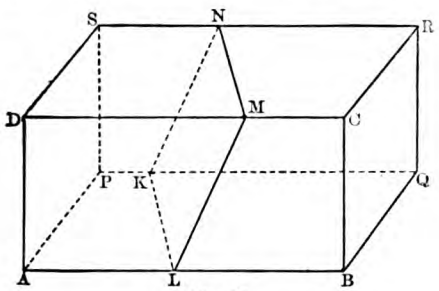


Fig. 25

Let A B C D, P Q R S be a parallelepiped.

Then since the $\parallel$ planes P R and A C are cut by the plane D R

$\therefore$ C D and R S are $\parallel$.

Similarly C R and D S are $\parallel$.

$\therefore$ D C R S is a $\square$.

Similarly every face of the parallelepiped is a $\square$

Also $\because$ A C is a $\square$ $\therefore$ A B = C D.

Similarly P Q = S R and A P = D S and B Q = C R

$\therefore \square$s A B Q P and D C R S are equal.

Similarly the other opposite faces are respectively equal.

Now let any plane K L M N cut the parallelepiped.

Then since $\parallel$ planes A Q and D R are cut by K L M N

$\therefore$ K L is $\parallel$ to N M.

Similarly K N is $\parallel$ to L M

$\therefore$ K L M N is a $\square$.

29. *The four diagonals of a parallelepiped are concurrent, and bisect each other.*

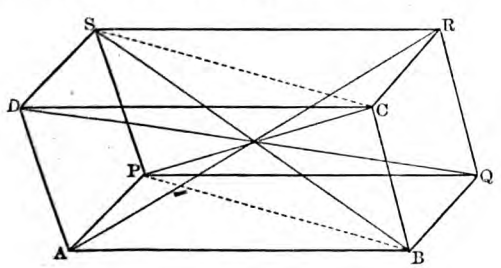


Fig 26.

Let A B C D, P Q R S be a parallelepiped.

B C and P S are each equal and $\parallel$ to A D

$\therefore$ B C = P S and is $\parallel$ to it

$\therefore$ B C S P is a $\square$

$\therefore$ Diagonal B S passes through mid pt. of P C.

Similarly the diagonals A R and D Q pass through mid pt. of P C $\therefore$ the four diagonals are concurrent.

30. *If a pyramid be cut by a plane parallel to its base, the section is similar to the base.*

Let O, A B C . . . . be a pyramid of height O M.

Let P Q R . . . . be a section of the pyramid made by a plane $\parallel$ to A B C . . . .

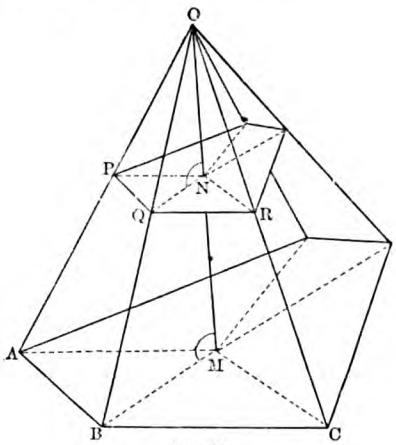


Fig. 27.

A B is $\parallel$ to P Q. B C is $\parallel$ to Q R

$\therefore \angle$ A B C = $\angle$ P Q R (i); similarly for the other $\angle$s.

O N M is $\perp$ to the bases $\therefore \angle$ O M B = $\angle$ O N Q = a rt. $\angle$.

$\therefore$ O Q : O B = O N : O M.

But P Q : A B = O Q : O B $\therefore$ P Q : A B = O N : O M

Similarly Q R : B C = O N : O M

$\therefore$ P Q : A B = Q R : B C = ...

$\therefore$ A B C . . . and P Q R . . . . have corresponding sides proportional and they are equiangular.

$\therefore$ they are similar.

Corollary 1.—*Since the ratio of similar polygons is equal to the duplicate ratio of corresponding sides.*

$\therefore$ Area of the section P Q R . . . . is to the area of base A B C . . . . as P Q^2 is to A B^2, i.e. as O N^2 : O M^2 *or, area of any cross section made by a plane parallel to the base of a pyramid is proportional to the square of its depth below the vertex.*

Corollary 2.—*If pyramids of equal height and with bases of equal area, be cut by parallel planes at equal depths below their vertices, the sections are equal in area.*

31. *The lines joining the vertices of a tetrahedron to the centroids (or centre of gravity) of the opposite faces are concurrent.*

Let A B C D be a tetrahedron.

Let P be the centroid of $\triangle$ B C D.

Let S be the centroid of $\triangle$ A B C.

Let L be the mid pt. of B C.

Then P lies on D L and S lies on A I.

$\therefore$ A P and D S both lie in the plane A D L.

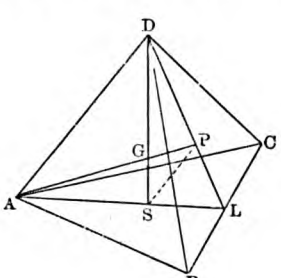


Fig. 28.

Now A P and D S are clearly not parallel.

∴ they intersect. Let their point of intersection be G. Join S P.

Now L S = $\frac{1}{3}$ L A and L P = $\frac{1}{3}$ L D

∴ S P is ‖ to A D and S P = $\frac{1}{3}$ A D.

∴ △s G A D and G S P are similar.

∴ G S : G D = S P : A D ∴ G S = $\frac{1}{3}$ G D = $\frac{1}{4}$ S D.

If Q be the centroid of △ A C D and R is the centroid of A B D, we can similarly show that B Q and C R intersect D S at a point one-quarter of its length from S.

i.e. the lines joining the vertices to the centroids of the opposite faces are concurrent at G.

Corollary 1.—*The planes each containing an edge of a tetrahedron and the middle point of the opposite edge, all pass through one point.*

Corollary 2.—*The lines joining the middle points of pairs of opposite edges of a tetrahedron are concurrent, and are bisected at their point of intersection.*

32. **If several planes meet at a point they divide space into two parts:** one the part shut in by the planes, the other the part outside the planes. These portions are called **solid angles.** As a rule by a solid angle we mean the part shut in by the planes.

A solid angle bounded by 3 planes (such as that at the vertex of a tetrahedron) is called a **trihedral angle.**

33. *The sum of the plane angles which bound any convex solid angle is less than four right angles.*

Let the solid ∠ O be bounded by n ∠s and let the planes of these ∠s be cut by a plane I, so that the lines of intersection form the n sided polygon A B C D . . . .

In △ A O B

∠s A O B + O A B + O B A = 2 rt. ∠s.

Similarly for the other △s.

∴ Sum of vertical ∠s of △s + sum of base ∠s of △s = $2n$ rt. ∠s.

The 3 plane ∠s at B form a solid ∠.

∴ the 2 base ∠s of △s at B are > ∠ of polygon at B.

∴ Sum of all base ∠s of △s > sum of ∠s of polygon.

∴ Sum of all base ∠s of △s > $(2n-4)$ rt. ∠s.

But sum of all base ∠s of △s = $2n$ rt. ∠s less sum of all vertical ∠s

∴ sum of all vertical ∠s < 4 rt. ∠s.

34. *There cannot be more than five regular polyhedra.*

At least three faces must meet at each corner and the sum of the plane ∠s at each corner is < 4 rt. ∠s.

Hence the ∠s of the regular polygons forming the faces of the polyhedron must be < $\frac{4}{3}$ rt. ∠.

∴ the faces can only be equilateral △s, squares or regular pentagons.

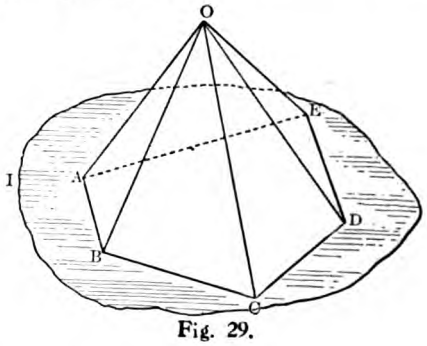


Fig. 29.

The ∠ of an equilateral △ = $\frac{2}{3}$ rt. ∠s.

∴ not more than 5 equilateral △s meeting in a point can form a regular polyhedron.

Thus we can have regular polyhedra formed by 3, 4 or 5 equilateral △s meeting at each corner.

∵ the ∠s of a square each = 1 rt. ∠

∴ only one regular polyhedron can be formed in which 3 squares meet at each corner. Such a regular polyhedron is called a **cube.**

∵ the ∠s of a regular pentagon each = $\frac{6}{5}$ rt. ∠

∴ only one regular polyhedron can be formed in which 3 pentagons meet at each corner.

Regular polyhedra.

(1) **Regular tetrahedron** formed by four equilateral △s.

(2) **Cube** formed by six squares.

(3) **Regular octahedron** formed by eight equilateral △s.

(4) **Regular dodecagon** formed by twelve regular pentagons.

(5) **Regular icosahedron** formed by twenty equilateral △s.

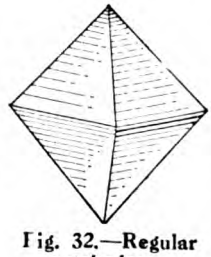


Fig. 32.—Regular octahedron.

Key to Exercise 2

Most of these solutions are only approximate.

(1) 31·42 inches. (2) 7 ft. 10·25 in. (3) 14 yds. 2 ft. 9·2 in. (4) 12·57 sq. in. (5) 314 sq. ft. 22·9 sq. in. (6) 4 sq. m 455 acres 3 roods 22 sq. po. 17 sq. yds. 8 sq. ft. 24·8 sq. in. (7) 7 sq. yds. 6 sq. ft. 117 sq. in. (8) 8 sq. yds. 3 sq. ft. 45·3 sq. in. (9) 1 sq. ft. 100·7 sq. in. (10) 50 inches. (11) 16 inches. M. A. L.

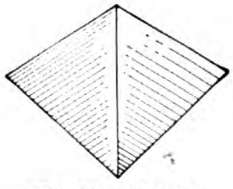


Fig. 30.—Regular tetrahedron.

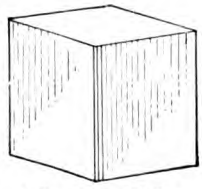


Fig. 31.—Cube.

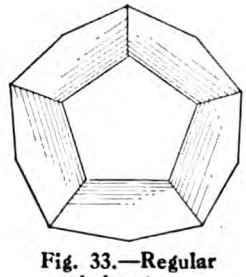


Fig. 33.—Regular dodecagon.

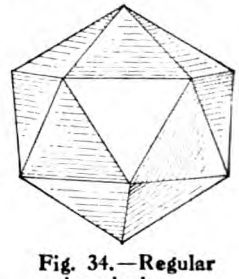


Fig. 34.—Regular icosahedron.

Continued from page 176.

ART AND MUSIC:

Contributors **:—THE THEORY OF ART (Hon. John Collier; J. G. B. Lynch). DRAWING AND PAINTING (J. G. B. Lynch). THE THEORY OF MUSIC (R. R. Terry, Mus.Doc., F.R.C.O. ; Hubert Grant).**

OIL PAINTING.—I

"To whatever use he may mean to put his art eventually," writes Mr. Collier, the well-known painter, of a beginner in oils, "the one thing he has to learn *as a student* is how to represent faithfully any object that he has before him. The man who can do this is a painter, the man who cannot is not one. Of course, there is more to be done in painting than this, but once this power has been attained the student stage is at an end—the workman has learnt his craft, he has become a painter."

These words sum up one side of the question very completely. In other words, you must not attempt to run before you can walk. It is not for ever and ever necessary that you should paint only what you see, but before you employ your imaginative faculties you *must* know how to paint well and accurately everything that you *do* see, whether it be a face, a landscape or a piece of furniture.

Employment of Colour

This of course applies to all forms of painting and drawing. When, as now, we have to consider the subject of painting in oils, it is really difficult to know where in this immense field of activity you are to begin. There are innumerable preliminary points which must be dealt with, and if in describing them you find advice repeated more than once now and again, you must bear in mind that such advice is important, and has been emphasised by all the highest authorities.

Materials are necessarily of a more complicated order than any required for mere drawing and water-colour work; and, incidentally, more expensive. It follows very naturally that you will not attempt the use of oils until you have become thoroughly proficient with your pencil. You must know how to draw. You must understand perspective; and you must understand the use of colour. So far as the application of the brush goes, water-colour work will not teach you anything. The *methods* used respectively for water-colour and oil-colour are entirely different. But the employment of colour as such will come easier to you after a course of water-colour work. The values of certain reds, the difference between warm colours and cool ones, and in some cases the mixture of two colours with a view to producing a third—these things will come as a matter of course with greater ease when you have made yourself thoroughly proficient with the sable-hair brush and the water and soluble hues

Draughtsmanship

Remember that in order to be a good painter in oils it is not in any way needful to be a peculiarly good draughtsman; that is, it is not necessary to have any special skill in the use of the pencil, provided always that you can draw accurately. When I said above that you must know how to draw, I did not mean that you should be a master who can make wonderful pictures with the pencil alone. In oil painting you *draw* with colour, so to speak; and so you must learn to wield your brush with as certain a touch as the skilled draughtsman wields his pencil. There is an order in making your preliminary drawing which must steadfastly be observed. First of all you find the exact relative position of each object to its neighbour and to all the other objects. Never begin to draw any one thing until you are certain of its relative position. After that you must discover each object's relative size. That done you have to determine its shape. Then having settled all these things you must go through the whole process over again in order to determine the proportion of one part of any single object to the rest. Having done this you may lastly pay attention to the smaller details.

Anyone who can make a pretty accurate drawing should begin with *still life:* this

is the arrangement of one or more objects which are not liable to any change. Some china ornaments on a mantelshelf, a table with a chair near by, and on the table some books, a silver box, a flower vase. These and kindred objects are treated as "still life."

Whilst you are still quite a beginner it is well to eschew any object in which there are elaborate details. Put your objects in a light which changes as little as possible and with a simple background. A north light is always best and is usually chosen by painters, because there is less variation in light from that point of the compass during the day than from any other point. A studio with a properly arranged north light is a luxury and is out of the reach of the majority of beginners. There is no real need for it at first. Every house has some room which can be used for painting, where the light is steady for a certain period in every day.

Windows and Light

You should, where the window is a very small one, have your easel near to it. It is highly important that what light there is should be on your work. So, in the case of the ordinary window, have your picture near to it and sideways to it. In a regular studio there is always some light from above, which is the best of all. But you must not reckon that this is in any way necessary at the outset, whilst you are learning.

Both object and painting should be in the same light, and these should both be arranged so that from time to time you can compare the one with the other. It is very necessary to do this rather often. How else are you to tell whether your picture is at all like the objects which it is intended to represent?

Now as to *M aterials*, the first thing to procure is canvas. There are various things on which you can paint in oils—w ooden boards amongst others—but for students it is better to begin on canvas, stretched, and in size about twenty inches by twenty-four. There is no harm in having a larger canvas, but it is an unnecessary extravagance for a student at the outset of his career. Smaller sizes than the one named should be avoided, as these are apt to make your work mean and niggling. You must have a strong, sturdily-made easel—one that will not shake when you touch it—and it must be tall enough for you to work on your canvas in a standing position. Do not get the usual three-legged easel. With such the canvas must slope backwards, and it is important that it should stand before you vertically. True, that appliances can be obtained which hold your canvas straight up even on the three-legged easel, but it is much better to have a good easel which naturally holds the canvas straight. Also, with these better kinds you can move your picture up and down at will, and this is highly important. For you ought always to be painting on a level with your eye, and thus the easy shifting of the canvas up or down becomes imperatively necessary. The still life arrangement which you are setting out to paint should also be on the same level. For this reason small objects can be raised on boxes, or, better still, you should where practicable have a little dais, which will take a table and chair and on which two or three people can sit or stand at one and the same time, when you come to more ambitious work. The drawing you make on your canvas preliminary to the laying on of colour must be in charcoal. Charcoal is easily erased, for one thing, and easily managed as well.

Distance and Effect

You ought to have your object some distance away, so that you get a fair view of it. Also you should stand as far away from the easel as is consistent with the proper control of your materials. Draw with your arm stretched out. This will not be altogether easy at first, particularly when you have spent some time in drawing in the usual way with pencils on a drawing board. But it will come well enough with practice and you will see that it is the inevitable way in which to paint. Remember this as a rule always to be observed with painting: *Continually step back to see the effect of what you have been doing.* This is the only way in which to secure any hope of success. You cannot judge a painting, particularly in its preliminary stages, by looking at it close. Also remember to keep on comparing the picture with the object or objects it depicts. If the objects and the picture are of the same size—that is to say, if you are painting life-size—you should put the two together and then look at them from a distance. If the size is not life-size—that is, in nine cases out of ten, when you are painting smaller than the actual object—arrange the two in such relative positions, the painting and the object, that, looked at from a distance—the far side of the room or studio—they appear to be the same size. How to judge this comes from practice without any great degree of trouble. When you see them together like this, you are bound to be able to observe any points where the picture does not coincide with that which it is meant to represent.

By this means you can learn a very great deal entirely by yourself without teaching. No man can learn everything without personal instruction—that goes without saying: but if you carefully follow out the rules laid down you can assuredly learn a great deal. Sir John Millais, to take one instance of many, continually walked up and down, comparing the picture and the original, giving a touch or two at a time with his brush; then away again to make sure that these little touches were accurate and to observe closely for the next. It is not to be said definitely that this method of perpetual walking up and down is absolutely necessary, but you come to no harm by following it. J. G. B. L.

Continued from page 248.

BUSINESS AND COMMERCE:

Contributors:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).

COMMERCIAL TRAINING.—XXXIX

MARINE insurance is an indemnity against actual loss. Just as with fire insurance, a marine policy (even though it may be for a given amount) is deemed to cover only definite loss, with one exception that will be shown later.

In order to define a policy of marine insurance, it is best to describe it as a contract under which the person assured is indemnified against the "losses of marine adventure," this latter old-world term including not only ships and goods, but also the earning of profit, commission, passage money and so on.

Marine Insurance

In these days there are many well-known and exceedingly rich insurance companies that specialise in marine matters, and a great deal of this type of business passes through their hands; though even these companies frequently pool the largest of their risks with other companies or with underwriters.

These latter men, who form the alternative to the companies when insuring against marine risks, are a group of persons who subscribe their names to marine policies, and they form as it were the fountain head of this type of business, being most of them members of Lloyd's.

To insure a ship, or its contents, or both it is necessary to go either to a marine insurance company or to an underwriter. In the former case the insured person, who must by law have a financial interest in the ship or goods, calls at the offices of the company and fills up the equivalent to a proposal form, which becomes the basis of the contract, and specifies vital information concerning the ship and her class at Lloyd's, details of the voyage, nature of the goods carried, and so on.

Underwriters in shipping stand in much the same relationship to the public as do barristers in the legal world. That is to say, just as a barrister is only approachable through a solicitor, so an underwriter is only to be reached through an insurance broker; and members of this latter profession are to be found in every centre of shipping. Neglecting the companies, therefore, and deciding to do his business direct with the underwriters an applicant for insurance goes to an insurance broker. But, instead of filling up a proposal form he hands to the broker a memorandum or "ticket" which supplies full details of the required policy; though of course this slip is in no sense the policy and cannot be stamped.

Different Types of Insurance

It is the business of the insurance broker then to take this slip to one or more underwriters; and it may here be explained that any one risk is almost invariably divided among underwriters. The slip, then, is inspected by the first underwriter, who specifies upon it the precise proportion of the risk he is prepared to take and appends his initials. The broker then visits a second or other underwriters until the full risk is covered, when the policy is prepared, this latter document also specifying the individual risks of the underwriters.

There are several different types of marine insurance, each designed to meet certain eventualities and to cover certain risks. Thus (and this applies more particularly to ships themselves) there is first of all the "Time" policy. Under such a policy the risk of loss to a ship is covered by the insuring company or underwriters usually for a period of one year and thirty days, these thirty days forming a period of grace for the renewal. During this time the owners are indemnified against loss to their ship, whatever voyages she is engaged in or wherever she may be.

A second type of insurance has to do with the risks of a specified voyage, and is termed

a " Voyage " policy. The details of the voyage are entered in the policy ; and it is part of the contract that the voyage shall be accomplished without any undue delay, and that the routes and customs of navigation and trade shall be closely followed, a deviation from the usual route being taken to break the contract unless there are exceptional circumstances.

A third type of policy is known as a " Valued " policy, and in this case the actual values of the ship or goods to be insured are definitely stated in the policy. In such cases the agreed value is accepted as proof positive, even though the ship or goods might not be of that value at the time.

An " Open " policy of marine insurance is one in which no set value of the ship or goods to be insured is named in the document, such value being left for proof should any loss ensue.

Motor Car Insurance

Motor car insurance presents a great many points of view and is more expensive proportionately than other types of insurance because the risks run are so much greater and of so many varieties.

What usually occurs is that the owner joins one or other of the motoring organisations and effects an insurance through this society, part of the agreement being usually that he is also indemnified against legal expenses arising through the use of his car or cars. There are many insurance companies, however, who specialise in this type of business.

Plate glass insurance is a separate branch of insurance business of which shopkeepers with a large area of glass in their windows may avail themselves. The basis of the insurance is the proposal form, and special rates are quoted to meet every particular case.

Yet another form of insurance of vital importance to the man of business is that dealing with workmen's compensation ; and there are many powerful companies covering this type of risk. The premium rates charged differ according to the circumstances of the case, nature of the trade and so on, and vary from the simple policy issued for domestic servants to the far more comprehensive document dealing with the employees of a vast works.

For a great many years the employer has had certain responsibilities to those looking to him for their wages, but it was not until 1906 that the all-embracing Workmen's Compensation Act came into force. This Act gave to every employer of labour actual responsibility for every accident to an employee arising out of, and in the course of, his employment ; and, following upon the accident, the employer is called upon to pay compensation.

It is to seek an indemnity against the payment of this compensation that an employer takes out an insurance policy, but the policies themselves vary according to the premiums paid and to actual requirements. Some policies are so framed as to take from the employer not only the amount of compensation to be paid, but also sick pay, if any, and medical costs in some circumstances; also, where found necessary, legal charges. Other policies merely cover the actual compensation to be paid by law, and omit one or other, or all, of the other benefits. It is almost entirely a matter of the amount of premium paid, and of the actual legal liability of the employer, this varying slightly in the different callings.

Employers' Liability

Employers' Liability covers a different field from that of the Workmen's Compensation Act, for it has to do mainly with manual workers. Broadly, the liability of an employer to pay damages for an accident to an employee is dependent upon these points :

In the first place, it would have to be satisfactorily proved that there was some actual defect in the machinery, plant or other appliances through which the employee was injured ; and also that the defect was caused or passed unnoticed by the *negligence* of the employer or of those placed in authority by him.

Negligence, in fact, is the foundation stone of this particular Act, for a second provision in the claiming of damages is proof that an accident was caused through the negligence of someone engaged in superintending at the scene of the accident. Again, another basis of claim would be the negligence of a person to whose directions the injured party was called upon to conform.

Defective rules and their observance have been the cause of Employers' Liability actions ; but it should be made clear that the employee who has suffered accident is precluded from recovering damages if he knew that there were defects in machinery, plant and so on, or if he knew that someone upon whose orders he depended had been guilty of negligence, the point being that in these circumstances the worker should have made formal complaint.

Under this Act, notice of an accident must be given to an employer within six weeks of the time of the injury; and legal actions concerned with Employers' Liability must be brought forward in the County Court.

A. B.

CHOOSING A CAREER.—XLIV

Lloyd's.—That enormous mercantile undertaking in the City of London at the Royal Exchange actually began many years ago in a coffee shop, but Lloyd's is now the largest assembly of underwriters in the world. To become an underwriter at Lloyd's, that is, to be in a position to undertake marine insurance work, is naturally an expensive venture. For one thing, there is an entrance fee of £400 and an annual subscription of twenty guineas; but, in addition to this, the candidate is called upon to lodge with the Committee securities to the value of £5,000.

Lock Keepers.—In most cases a cottage adjacent to the lock goes with the lock keeper's wages, which are invariably small. Men who have had some experience of boats and barges stand the best chance of securing appointment. So far as the River Thames above Teddington is concerned, application for a position as lock keeper should be addressed to the Thames Conservancy Offices, London, E.C.4.

There are nearly 5,000 miles of canals in Great Britain with a proportionate number of lock keepers; but, in the case of the canals, the candidate should ascertain the address of the chief office of the canal on which he wishes employment.

Manicurists.—In fashionable districts there are men and women who have established themselves as manicurists and masseurs or masseuses; and, so far as the medical faculty is concerned, there is an increasing demand for the services of trained massage experts. In connection with many of the highest class hairdressing and toilet establishments manicurists are also retained and many of them specialise in the electric-vibro treatment. To take up this career as a means of livelihood the best plan is for the candidate to serve for a time as a learner to someone practising.

Messengers.—Throughout the Government offices there is employment for messengers, but in most cases those appointed have served either in the Navy, Army or Air Force. Before appointment a simple examination in writing, dictation and arithmetic has to be passed, and candidates should communicate with the Secretary, Civil Service Commissioners, Burlington Gardens, London, W.1.

In London there is a considerable force of District Messengers, with stations and offices at different parts of the City and West End. The boys, who are provided with uniform and boots free, gain a good deal of useful experience during the period of their service and seldom find difficulty in obtaining a post when they reach the age limit for leaving. Application for appointment should be made to the Manager, District Messenger and Theatre Co., Ltd., 100, St. Martin's Lane, London, W.C.2.

Millers.—There is more and more a tendency for the old-fashioned mill on the river's bank to give place to the modern barrack containing electrical and steam appliances, steel rollers and all the scientific paraphernalia of a factory.

At the same time, in these modern mills there is always an opening for young men possessed of skill and ingenuity. To take the office staff first, there is every opportunity for a clerk to become a buyer (a most important post), a sampler, a wholesale or retail salesman and representative or manager of a large department. Shipping matters run very closely with milling, and the clerk should clearly understand bills of lading, insurance and similar technical subjects. On the mechanical side there are openings for skilled engineers, electrical specialists, lighting experts and others.

In many mills premium pupils are taken, the premium of £100 or £150 being partially returnable in the form of a small salary.

Milliners.—The majority of girls commence as learners in the workroom. In high-class establishments a premium has to be paid. In the suburbs and the provinces generally a learner gives about two years of her time free in the workroom. At the same time, in addition to their experience in the workroom and occasionally in the show-room, most of the girls attend evening classes where they are taught the principles of hat measurement, of making wire shapes and fancy flowers, and of copying actual models.

Miners.—The majority of working coal miners commence life as pit boys where they are employed in the driving of ponies, the opening and closing of the brattice doors, and in similar duties. From 14 to 16 is the usual age for commencing, but by the time a lad is about 19 he will have become a coal-getter. In some districts many boys are employed at surface work, sorting the slag

and slate from coal as it passes them on an endless band, and a few are engaged at the screenings.

From the point of view of self-education there is much for the pitman to learn if he would attain to the position of underground manager; but a knowledge of gases, metallurgy, mining chemistry and such matters is obtainable through technical classes by those workers who are sufficiently keen to spare the time from their leisure. Even underground as well as at the surface offices there are coal-mine clerks; and lamp men, stable men, onsetters to the cage, attendants to electrical haulage machinery and countless others are employed. At all events, no intelligent lad need seek work in a pit with the idea of rising no higher than the position of hewer, even though the latter earns very high wages.

Motor Workers. — Beyond the body building and the engineers employed in motor manufacture there are the dealers, who open shops and act as agents for the wholesale firms. It requires a most comprehensive knowledge of cars and considerable capital to found such a business, and even more where the stock consists mainly of second-hand cars bought for cash.

Businesses conducted for the sale of motor appliances and fittings are profitable; but far more so when a repair shop is added to the establishment, and repairers on busy main roads are seldom short of work, particularly if they are recognised by the A.A. or R.A.C. (Royal Automobile Club), both of which organisations grant iron plates to hang upon business premises, testifying that the proprietor has been registered as an efficient repairer.

So far as chauffeurs are concerned, those who are able to drive any make of car and to perform minor running repairs can command the best wages. To become a chauffeur one should attend at a recognised school of motoring. Motor bus drivers in the employ of public companies or municipalities are invariably taught in an official school. They are usually paid on a system of journey money, so much for each completed run with a fixed minimum.

Naturalists. — Generally speaking, a naturalist is also a taxidermist and conducts a shop for the sale of natural history specimens. Men (or women) who possess a keen love and instinct for natural history should first of all obtain a post as assistant at an established business and should do all in their power to widen their knowledge of nature, the forming and preserving of collections of specimens, the stuffing and setting up of animals, the care of pelts, the value of shells, birds' eggs, butterflies, and similar objects. The profits of such a business are dependent entirely upon the district and the personality of the proprietor.

Navy.—There are openings in the Royal Navy for ratings of all kinds; and the senior service may well be taken as offering a life-long career with a pension at the end. The latest details of pay and promotion, enlistment and pensions, may be obtained both for the Royal Navy and Royal Marines by inquiring at a naval recruiting station, the address of which will be given at any post office. So far as commissions in the Royal Navy are concerned, they are granted only to those boys who begin at a very early age at the Royal Naval College; the cadets, however, have first to obtain a nomination from the First Lord of the Admiralty and also to pass an educational and a medical examination.

Newsagents.—Only too frequently this business is taken up by those with slender capital who have failed at other callings and who have recourse to a newsagency as a last hope. As a matter of fact, the business is one calling for far more knowledge than might appear on the surface, and a newsagent who is a thorough master of the subject should succeed admirably.

The person proposing to set up as a newsagent should have won some personal experience of the trade as a paid employee. He (or she) should then communicate with a firm of local wholesale newsagents from whom supplies may be purchased for regular delivery.

Nurses.—It would be difficult to conceive a calling more fitted for women than that of nursing the sick, but the work of preparation to adopt this career is most strenuous and exacting. The girl who would take up nursing should begin before her twenty-first year and should write to the matron of the particular hospital at which she desires to start. In due course she will be asked to call for an interview; and, if all is satisfactory, will be appointed a probationer. Probation varies according to the nature of the institution and may last for four years, but the routine varies. Vacancies for probationers are frequently advertised in *The Hospital*.

Once established as a nurse, a girl may remain at ward work, or join the group or staff that is sent to private houses. She may secure a post at a nursing home, or commence a practice on her own account. A. C. M.

SHORTHAND.—XXIII

Key to Exercise 79.

1. *In*-reply-*to-yours of-the* 8th, *we-think-the* best-time *to*-meet-*the* ladies-*and-gentlemen* referred *to will-be next* Monday-evening. *At-all*-events *we-shall-be-able-to* say definitely *in two-or*-three days, *when-we-shall* write-*you on-the*-matter. Needless-*to*-say *we*-would like both *your*-partners *to-be*-present *if-it-is at-all* possible.
2. *There-must-have-been* some delay *in*-connection-*with your* parcel after leaving-*us, as-we-think-you-will*-agree *when-we* state *that-it-was* despatched *from this*-city *on*-Thursday-evening. *Most-probably this* took-place *on-the* rail, *and you-should-be-able-to* fix *responsibility in-this*-matter.
3. *We-are more-or*-less bound-*to*-say *that-we-shall-be* unable-*to* carry-*on our* business *if-the*-present state-*of-things* continues. *It-is*-only-necessary *to* bear-*in*-mind *the* facts-*of-the*-matter *as* stated *at-the* meeting *two-or*-three weeks-*ago*.
4. *You-will-have to*-find some-*other*-means *of*-dealing-*with-the*-matter, *as in-our*-view *it-will-not-be* worth-*while* taking-*the* business *in-hand at-the* rate-*of-interest* quoted.
5. *We-have*-received-*the* samples *you*-mentioned last-month, *and-we-think-there-will-be a* good market *for-this*-class *of*-goods *in-this* city. *We-shall* write further *as*-soon-*as-we-can*.

Intersections.—In Lesson 22 we referred briefly to the general application of the principles of phrasing, and have shown how compact and readable outlines may be formed for the representation of common words and phrases. This method of simple joining, however, does not always supply us with the most convenient forms, especially in the case of official titles, of individuals, or of various associations, or for numerous colloquial phrases. To assist the writer in the rapid representation of such combinations of words, the principle of intersection, or the writing of one stroke through another, is utilized. It will be remembered that this device is employed in the case of certain contractions, of which *misfortune*, *nevertheless*, *notwithstanding*, are examples.

By the same method intersections representing two or more words may be formed. In certain cases, however, intersection is not practicable, and in such cases proximity is adopted. Examples of this will be seen in the lists following.

Intersections may be divided into two classes, namely "General" and "Special." In this Lesson we shall deal chiefly with the "General" Intersections, as the "Special" Intersections are employed largely for special businesses or on special work.

General Intersections.—General Intersections are for general use, and are employed in ordinary correspondence and matter of a general nature. The majority of the phonographic consonants are employed to express certain words when intersected. The chief point of such contracted forms is that they must be easily written and legible at sight. The following list, which, of course, is by no means exhaustive, should be carefully studied, so that there may be no hesitation in the general application of the principle.

Sign.	Word.	Example
\	party	*political party*
\	policy	*insurance policy*
\	professor	*Professor Dickson*
\	superintendent	*Passenger Superintendent*
\	bank	*bank rate*
\	-bankment	*Thames Embankment*
\	bill	*bill of lading*
\	bishop	*Bishop of Ripon*
|	attention	*necessary attention*
|	department	*engineering department*
/	Chancery	*Chancery appeal*
/	charge	*extra charge*
/	journal	*Pitman's Journal*
–	company	*Gas Coy.*
–	council	*County Council*
–	capital	*share capital*
–	captain	*ship's captain*
⌒	Company, Ltd.	*Steamship Co., Ltd.*
⌒	colonel	*Colonel Dean*
⌒	corporation	*Corporation of Leeds*
—	government	*Labour Government*
⌒	form-ed	*matter of form*
⌒	form-ed	*quickly formed*
⌒	forth	*bring forth*
⌒	valuation	*weekly valuation*
⌒	convenient-ce-ly	*early convenience*
(	authority	*local authority*
(	month	*many months ago*

society — *medical society*

scientific — *scientific research*

assurance — *life assurance*

mark — *mark of respect*

major — *Major Johnson*

morning — *this morning*

national — *national finance*

communication — *further communication*

liberal — *liberal payment*

limited — *Dicks', Limited*

arrange-d-ment — *I shall arrange*; *it was arranged*; *better arrangement*

railway — *railway company*

conservative — *Conservative Party*

NOTE: In the case of the intersected — for *Government*, it should be noted that this is used only to a limited extent, namely, in cases where there is no danger of its being mistaken for — representing *Company*. Sometimes is used, as in *form of government*, while in certain cases, where in very fast note-taking might possibly be misread as , representing *Cabinet*, the ordinary contraction is employed, thus *this Government*.

The word *month* is generally represented by the intersected (, as shown in our list, but in certain phraseograms, especially after circle *s*, it is preferable to join the stroke, as in *this month*, *next month*, *end of the month*. In some instances it will be found that the use of the full outline provides the most facile form, as in *three months*, *last month*.

Special Intersections.—These Intersections, as already explained, are employed only in special businesses or on special occasions, and do not therefore so much concern the general student.

The following are a few miscellaneous examples of this class of intersection: *ratepayers*, *Leader of the Opposition*, *refer to drawer*, *claim for compensation*, *Workmen's Compensation Act*, *heating apparatus*, *official receiver*.

The Publishers of Pitman's Shorthand, to meet the demands of shorthand writers engaged in particular trades, have issued a series of publications entitled *Shorthand Writers' Phrase Books and Guides*, each book dealing exclusively with one particular trade or profession, and containing comprehensive lists of special phrases and intersections. Particulars of these books may be had on application to the firm.

When the student has mastered the principles of intersection as explained in the foregoing lists, the following exercises should be attempted. The key will be supplied with Lesson 24.

Exercise 80.

1. The garden-party at Colonel-Johnson's house on-the river-embankment was-given special-attention in-the Weekly-Journal.
2. My-attention-has-been-called to slackness in-the Silk-Department, and-I-shall-be-glad if-you-can-arrange to-give early-attention-to-the-matter.
3. The military-authorities, in-answer to-our request, have-sent-us the necessary-form to-be filled in. Major-Jackson promises the matter shall-have immediate-attention.
4. The railway-rates having-been increased, we-find we-cannot allow such liberal-discount as ruled some-months-ago. You-will-find-the new rates on-the attached form-of-agreement, and-we-shall-be-glad to-have your written-authority to-proceed.

Exercise 81.

1.
2.
3.
4.
5.
6.

Continued from page 254.

ENGLISH LANGUAGE AND LITERATURE:

Contributors **:—ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).**

NINETEENTH CENTURY POETRY.—IV

ROBERT BROWNING, born in London in 1812, educated privately and at University College, London, was the poet contemporary with Tennyson whose work showed the greatest range and power. Like Tennyson he devoted his life to his art, his first book *Pauline* being written before he was twenty-one, and his last, *Asolando*, appearing on the day of his death, December 12, 1889.

In 1846 he married Elizabeth Barrett, whose popularity as a poet in her lifetime far exceeded his own. Mrs. Browning died (1861) in Florence. Much of Browning's life was spent abroad, and nearly all his poems have a foreign setting.

Pippa Passes

For many years his writings were regarded by the general reader as too cryptic to be understood, but from the first he had a slowly-growing literary repute, and he educated a wider public into an understanding of his style, which was as distinctively personal in verse as Carlyle's was in prose.

His earlier works, *Pauline*, *Paracelsus* (1835), and the obscure mediæval *Sordello* (1840) were philosophical studies of the aspirations of the human soul. He then turned to the drama and produced *Strafford* (1837), *A Blot in the 'Scutcheon* (1843), and *Colombe's Birthday* (1844), all of which have been staged temporarily, and *Pippa Passes*, the most poetical of his semi-dramas, but unplayable.

On his recovery from the death of his wife Browning wrote, through several leisurely years, the greatest of his works, *The Ring and the Book* (1868 and 1869). It centres on an Italian murder of the year 1698, and is an acute psychological study of the crime from the point of view of each person concerned in it and its investigation.

The most memorable poems in the half dozen volumes published after *The Ring and the Book* were nearly all psychological. A poem that illustrates exceptionally the poet's method and mannerisms, and is at the same time easily followed to a noble crescendo is *The Epistle of Karshish the Arab Physician*.

Browning's Shorter Poems

It is by such shorter poems as *Karshish*, *Andrea Del Sarto* and *Fra Lippo Lippi*, picturing the changing spirit behind Italian art; *A Grammarian's Funeral*, telling of the soul's aspiration for the ideal; *Cleon* sounding the hopelessness of Greek culture; the religious poems *A Death in the Desert*, imagining Saint John's last words to his faithful attendants; *Saul* and *Rabbi Ben Ezra*, which contain the essence of Browning's faith; *Abt Vogler*, suggesting the inner meanings of the music he loved; the *Soliloquy of a Spanish Cloister*, his study of hatred—*Before* and *After*, picturing the inadequacy of vengeance; such varied descriptions as *The Flight of the Duchess*, and *Up in a Villa*; ballads like *Hervé Riel*, *The Pied Piper* and *How They Brought the Good News*; and the poems that enshrine an ideal wedded union, the chief being the inimitable *By the Fireside*—it is by these less elaborate efforts rather than by his more formal works that Browning will be known in the long years that sift and clarify literary fame.

Mrs. Browning, born Elizabeth Barrett, had attained considerable popularity as a poet when in 1845, in her fortieth year, she first met Robert Browning. She was then living in London the life of an invalid, under the tyrannous power of an eccentric father, who objected to his children marrying.

From the portraits by Field Talfourd in the National Portrait Gallery.

ROBERT (1812–89) AND ELIZABETH BARRETT (1806–61) BROWNING,
whose ideal marriage is recorded ideally in immortal verse both by husband and wife.

Sixteen months later Browning married her without the parental leave and carried her off to Italy, where for the most part they lived during sixteen years of unalloyed happiness. The ideal Browning-marriage is recorded ideally in immortal verse by both husband and wife.

Elizabeth Barrett Browning

Before she met Browning Miss Barrett had written most of her best known lyrics, such as *Cowper's Grave*, *He Giveth His Beloved Sleep*, *Hector in the Garden*, *The Romance of the Swan's Nest*, *The Cry of the Children*, and *Lady Geraldine's Courtship*, with much more ambitious verse, including translations from the Greek poets. After her marriage she added a few lyrics, including *The Great God Pan* and *North and South*, the latter inspired by Hans Andersen; but much of her writing expressed her intense interest in the Italian struggle for liberty as in *Casa Guidi Windows*, whence she looked forth on the doings of Florence. Her most vital work, however, is in her misnamed *Sonnets from the Portuguese*, which were not translations, but original outpourings of the fervent love felt for her husband—her passionate counterpart of his romantically imaginative poem *By the Fireside*.

That inevitable infirmity of poets, the desire to write something long and formidable, led Mrs. Browning to produce *Aurora Leigh*, a tale in blank verse—a measure she manipulated with difficulty. The story, published in 1856, was read widely and reviewed favourably; but the narrative moves sluggishly, and its lasting interest is in the scattering of thoughts, views, and brief descriptions of scenes and characters that bestrew it, and not in its unity as a poem.

But though Elizabeth Barrett Browning's more ambitious writing does not as a whole work of art retain its power, she is the Englishwoman who takes the first place among women who have been poets, by virtue of her clear poetic impulse, the quality of her thought, and her lyrical expression of deep feminine sympathy.

Reverting to the earlier part of the century brief mention must be made of Thomas Campbell (1777-1844), a Glasgow merchant's son, who at the age of 21, wrote, in rhymed couplets, *Pleasures of Hope*, which went through many editions. In London, Campbell gained popular fame by his patriotic song *Ye Mariners of England*, his ode on *The Battle of the Baltic*, and a heart-stirring picture of *Hohenlinden*. His later poems included a story, *Gertrude of Wyoming*, in the Spenserian stanza.

Thomas Hood (1799-1845), a London born editor and humorist, was a truer poet than, hampered by ill-health, he had time to show. His *Song of the Shirt*, *Bridge of Sighs* and *Dream of Eugene Aram* give him a secure niche in literature.

Walter Savage Landor (1775-1864) lives in prose through his *Imaginary Conversations* between notable contemporaries of all ages, studies that are often brilliant, and often curiously uneven. Landor claimed a place for himself among the choicer poets, but his serious verse, such as his epic *Gebir*, is heavy, though he wrote some charming lyrical fragments. A generous, impulsive, violent, but noble-minded man, he quarrelled his way through life, and died abroad.

Thomas Moore (1779-1852), a gay little Irishman, became a "lion" in London society through the sentimental *Irish Melodies* he sang as well as wrote. He was a pungent newspaper satirist. His carefully-studied *Lalla Rookh*, an Eastern romance, once immensely popular, is now felt to be shimmering tinsel. Moore, who had a wide circle of literary friends, became Byron's biographer. His Irish songs sound hauntingly the plaintive national note.

American Poets

American poets of the century, for European readers, begin with William Cullen Bryant (1794-1878), a serious-minded journalist, who wrote nature-loving verse with dignity. Some of his shorter poems, such as the finely cadenced address *To a Waterfowl*, retain a deserved popularity.

Edgar Allan Poe (1809-1849), a man of unbalanced character, lived precariously by his pen. He studied musical effects in rhythms and rhymes, and succeeded in imparting a sense of eeriness to verse purposely vague in meaning. Through prose and verse Poe proved himself an adept in mystery. He has artifice in form and atmosphere rather than original thought or constructive imagination.

Henry Wadsworth Longfellow (1807-1882), professor of modern languages, ranked in popularity as a poet next to Tennyson throughout the English-speaking world. His studies led him to Spanish, Italian and Norse subjects, but the poems by which he became known were either early American in their setting, as *Evangeline* (1847), *Hiawatha* (1855), and *The Courtship of Miles Standish* (1858), or they were songs of childhood, youth's endeavours, manful duty, and life's tendernesses that appeal to all simple

natures. Not even Tennyson is so naturally a household poet. Longfellow's more ambitious works—*The Spanish Student* and *The Golden Legend*—do not attract later readers, but his shorter stories have vigour and atmosphere, and many generations will regard with friendship the scholarly poet who has stored the world with tender melodies of domestic sentiment.

John Greenleaf Whittier (1807-1892), the Quaker poet of the movement for the abolition of slavery, wrote a few poems so sterling in thought and feeling, and so apt in wording that his abundance of commonplace becomes remarkable. Whittier's poetic moments often found expression in hymns.

Oliver Wendell Holmes (1809-1894), the delightful essayist, wrote many graceful verses; and Francis Bret Harte (1839-1902), the novelist, sketched dramatic scenes of Western life, sentimental and humorous, as readily in verse as in prose.

The Biglow Papers

Walt Whitman (1819-1892) has been hailed as the characteristic poet of America. That he was a poet in essence none will deny, but much of his writing was perversely, and even unpoetically, odd. In him egotism was carried to its highest power. Literature requires something more than unsorted observation enumerated in a formless ecstasy. Whitman could furnish the something more, but often did not.

James Russell Lowell (1819-1891), takes a place beside Longfellow as a major poet. His serious verse includes some inspiring lyrics, and his *Biglow Papers* are the leading satire in modern English. Humour, humanity, and sturdy sense are in the "Papers" in equal proportions. Besides being a versatile poet Lowell was the most illuminating of American critics, and late in life became an accomplished ambassador of the Republic.

The most considerable English poets contemporary with Tennyson and Browning in the later life of the great moderns were Matthew Arnold, Algernon Charles Swinburne, and William Morris.

Matthew Arnold (1822-1888), son of Arnold of Rugby, and himself a Government Inspector of Schools, was almost equally distinguished as a literary critic, a writer on the literary foundations of religion, from which he hoped to clear away superstitious accretions, and as a poet. Whether writing in prose or verse, he imparted to his style a scholarly charm. His poems, classical in tone and finish, are penetrated by the sadness of a waning faith. They include, in *Thyrsis*, commemorating his friend Arthur Hugh Clough, an elegy that may be classed with Milton's *Lycidas* and Shelley's *Adonais*.

Algernon Charles Swinburne (1837-1909) was one of the poets who have sought to teach mankind in a passion. In 1865 he captivated Oxford with his *Atalanta in Calydon*, written under the influence of Greek classicism, an inspiration repeated in *Erechtheus* (1876). Between 1866 and 1889 Swinburne published four volumes of lyrical verse, under the titles *Poems and Ballads* and *Songs Before Sunrise*, and between 1876 and 1908 he wrote a number of formidable reading dramas. His prose criticism was copious and excited.

His place in literature is not fixed by his thought, which was nebulous; nor by his criticisms, in which insight was often distorted by violence; nor by constructive power as a poet; but by his skill as a metrical innovator. He gave greater fluidity to poetical forms, and made the lyric so song-like that it sounded well irrespective of the sense, while often the sense had a fine poetic glamour. His young contemporaries who chanted his swinging choruses felt he had added a new octave to the instrument of verse. The metrical gain from Swinburne is substantial and should not be decried, though at last he became so lavish in his lyrical outpourings that he seemed to be parodying himself.

Morris, Rossetti and Clough

William Morris (1834-1896) was a poet and artist who became a manufacturer in the hope of influencing taste in household decoration. His poetry embraced the re-telling of tales of classical mythology, re-fighting the rude battles of our Northern forefathers, and also arming modern Socialism with the spirit of song. He also used his prolific fancy to assist Socialism through prose allegory. In no modern poet has the pulse of romance beaten more strongly. There were curious contrasts between the artist and tradesman; between the trumpeter to "the people marching on," and "the idle singer of an empty day"; but all that William Morris wrote or did came from the heart of a poet.

Dante Gabriel Rossetti (1828-1882), the pre-Raphaelite painter, wrote in early life poems—of which *The Blessed Damozel* is the best illustration—that are the counterpart in words of his intensely-imagined, finely-coloured, aloof-from-life painting. Later, he wrote chiefly ballads and sonnets, with a delicacy that attracts the literary expert.

Arthur Hugh Clough (1819-1861) was one

of the serious, truth-loving poets, who drifted from religious anchorages on the rising tide of scientific inquiry. Much of his work was published posthumously from incomplete manuscripts. He is the subject of Matthew Arnold's exquisite poem *Thyrsis*. A charming man, sedulously honest, Clough wandered longingly towards fulfilment of his life's purpose, and never arrived.

Among women poets of the century Mrs. Felicia Hemans (1793-1835) deserved the popularity she won by the unaffected simplicity of her poems on what she called "the domestic affections."

Jean Ingelow (1820-1897) wrote with lyrical grace in a plaintive vein. Christina

From the portrait by G. F. Watts, R.A., in the National Portrait Gallery.

MATTHEW ARNOLD (1822–88),

the son of Rugby's famous headmaster, and distinguished equally as a literary critic and a poet.

Rossetti (1830-1894), sister of Dante Gabriel Rossetti, was mistress of an exquisite simplicity and musical cadence. Adelaide Ann Procter (1825-1864) subtly interwove true poetic feeling with religious devotion.

The novelists, Robert Louis Stevenson, George Meredith, and Thomas Hardy were all poets on lines that expanded the spirit of their tales. Stevenson wrote inimitably of and for children. Meredith's lyrics, like his prose writings, often only surrendered their secrets to study. Hardy, late in life, in *The Dynasts*, produced the finest poetical drama of his period, and proved that poetry was as natural a vehicle for his genius as prose.

Philip James Bailey (1816-1902), a Nottingham man, wrote an epic, *Festus* (1839), in its original form a fine effort of imagination, but a lifetime of elaboration changed it into a cumbrous and disjointed work.

Coventry Patmore (1823-1896), an official of the British Museum, wrote a sweet and

From the portrait by G. F. Watts, R.A., in the National Portrait Gallery.

WILLIAM MORRIS (1834–96),

poet and artist, who became a manufacturer in the hope of influencing taste in household decoration.

tender commemoration of happy married life under the title *The Angel in the House*.

Edward FitzGerald (1809-1883), a Suffolk gentleman, changed Omar, the Tentmaker of Persia, into a poet in English by his translation of a number of the old pessimist's quatrains, under the title *The Rubâiyât of Omar Khayyâm*. Life as a hopeless enigma has never been knelled in such haunting tones.

Francis Thompson (1859-1907), a young Roman Catholic poet, had instability of character but fine imagination and luxuriant resources of poetic expression. He reached his zenith with his *Hound of Heaven*, picturing the pertinacity of early religious impressions.

Robert Buchanan (1841-1901), poet, novelist, playwright, critic, of Scottish descent, lived in London a skirmishing life, giving and taking knocks. His slap-dash energy with

small restraint was too full-blooded to please the prevailing clique of critics ; but writing anonymously he won wide appreciation by his powerful American story in varied verse, *White Rose and Red*. His *Balder the Beautiful* is the most readable modernisation of the Norse myth, and in *Judas Iscariot* he sounded the true strain of balladry.

Under the title *The Light of Asia*, Sir Edwin Arnold (1832-1904), a vigorous journalist, wrote a metrical life of Buddha, which, for a time, was widely read.

Sir Lewis Morris (1833-1907), an ardent imitator of Tennyson, attracted attention by his *Songs of Two Worlds*. In *The Epic of Hades*, which followed, he gave modern meanings to the Greek myths. After *The Ode of Life*, itself a series of odes, Morris went on repeating himself indefinitely.

Graceful artificers in verse included, towards the close of the century, Dr. Robert Bridges (born 1844), who succeeded Alfred Austin (1835-1913) as poet-laureate ; Sir William Watson (born 1858), who has combined haunting poetry (as in *Wordsworth's Grave*) with delicately discriminating criticism ; Austin Dobson (born 1840), who has the light touch and finish of the French school ; and William Butler Yeats (born 1865), an Irish poet, whose verses echo vague yet glamorous airs from the borderlands of reality.

A revival of poetry came in the early twentieth century, rising into a crescendo with the emotion created by the World War, but these developments are too recent for comment here. One poet, however, must be mentioned. Rudyard Kipling (born 1865) bases his poetry fair and square on life. At first, the rougher the life the more it attracted him. A sentimental soldier, a drunken sailor, a battered banjo, whoever or whatever suggested travel, endeavour, romance, serve his purpose for a song with a fascinating lilt. At home from his Indian apprenticeship he soon picked up the historical " feel " of England ; and this he put into moving verse, as well as England's world-wide mission. J. D.

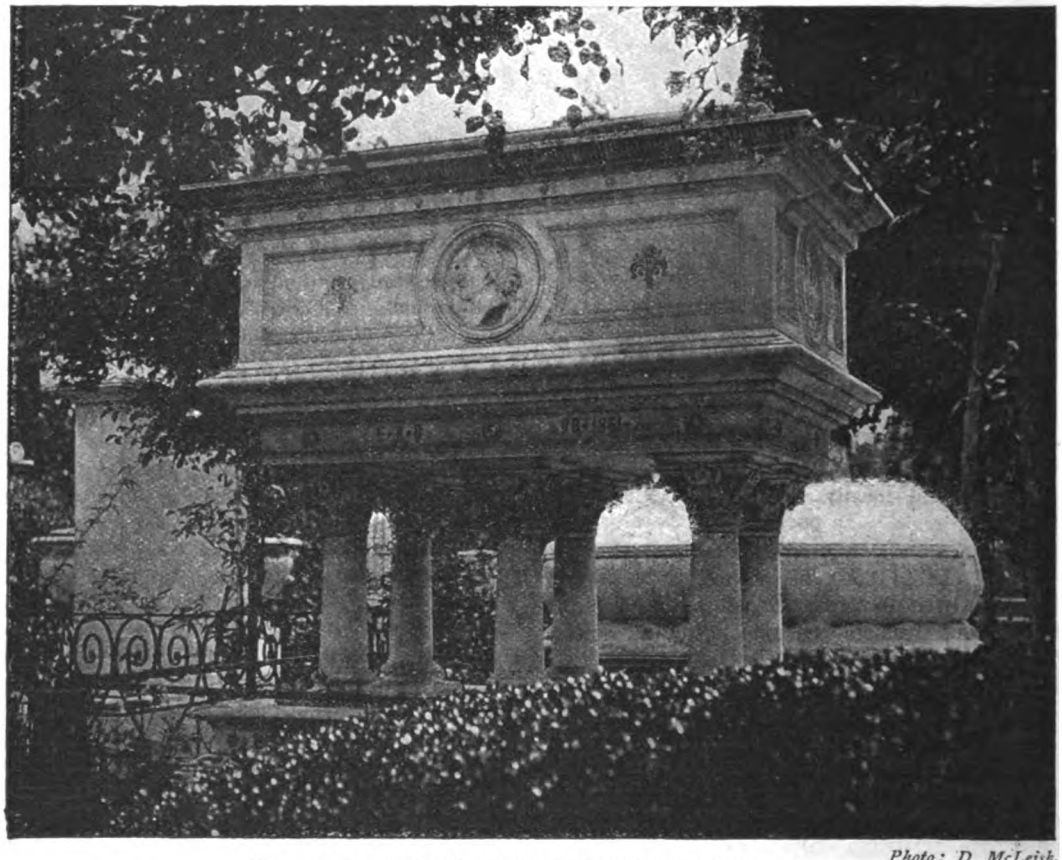


Photo : D. McLeish.

THE GRAVE OF ELIZABETH BARRETT BROWNING,

in the Protestant Cemetery at Florence. Elizabeth Barrett had passed her fortieth year when in 1846 she married Robert Browning.

POLITICAL ECONOMY.—VII

THERE is no part of our economic system which has caused so much discussion as the land question. Every political party has formulated a policy for dealing with the land problem. This is a certain and clear indication that some reform is necessary, and that the subject is one for most serious and careful consideration.

It is, however, impossible to approach the subject without a knowledge of the present system of land tenure and its history.

It is a common error to talk of the " ownership " of land. According to the English system there is no such thing as " ownership " when we refer to land. A person has a right in land, and the correct description is to refer to such person as " holder of the land."

Land is held subject to a variety of conditions and estates, but the ultimate ownership is vested in the King as the lord paramount.

The Feudal System

The English land system is a survival of the old feudal system, often said to have been introduced into this country by William the Conqueror, but there are traces of the feudal system under the old Roman Law some centuries before the Conquest. Under the feudal system all land was said to be held of the king as the lord paramount, and was granted out by him subject to certain services to be rendered, chiefly of a military nature.

It is impossible to understand, with any degree of accuracy, either the Civil Constitution of this kingdom or the laws which regulate its landed property without some general acquaintance with the feudal laws, a system which was universally received throughout Europe several centuries ago.

When the northern adventurers were seeking new settlements, they organised themselves under military leaders, and the conquered territory was distributed by the Chief (who exercised supreme authority among his immediate followers), not only as a reward for past services but on the condition of future services.

The allodial proprietors, exposed to every species of insecurity, were obliged to seek the protection of a neighbouring Chief, to whom they surrendered their lands on condition that they were defended by him and his armies, to have them granted to them again subject to rendering services to the Chief. By degrees the feudal Chiefs grew into powerful Sovereigns, and the Sovereigns of States already settled were compelled to adopt the feudal customs as the means for maintaining their authority.

With the Norman Conquest the allodial system was entirely or almost entirely superseded, and it became a maxim of English law that all land in England was placed mediately or immediately in the Crown and separated from the possessory title which conferred the right to the use and profits of the soil. The Norman Conquest was complete, and the rights or usages of Conquest were enforced to their fullest extent.

All owners of land were required to take the oath of fealty to the king, and lands of those who refused were confiscated and granted to the king's followers, and those who took the oath were permitted to hold their lands subject to giving service to the king. The services varied in kind, the most honourable being military service; the others were of a menial character: to plough the fields, to supply timber and so on.

Those who held their lands of the king, in their turn granted portions to their followers on condition of services similar to those they were themselves bound to render, and these vassals or serfs held their lands from their immediate lord, and in this way the varying tenures sprang up.

Systems of Land Tenure

The principal systems of land tenure are freehold, copyhold and leasehold.

The holder of a freehold is said to have a fee simple, or property in the highest degree.

An estate freehold may be disposed of by will or by deed unless there are restrictions, such as a life interest with special remainder, which is called an entail.

A freehold estate would, unless it was disposed of by will or deed, pass to the eldest son, and in the event of his death to his eldest son as heir at law, but in the event of the owner dying leaving no son but several daughters, it would pass to his daughters in equal shares.

The right of an eldest son to succeed to the property, that is the real estate or land of his father, is called the law of primogeniture.

In the event of a holder of land dying without a will and without heirs the land reverts to the Crown by escheat.

A copyhold is in law an estate less than a freehold, that is to say, it is an estate held subject to the will of the Lord of the Manor, and cannot be disposed of without his consent, the Lord of the Manor being the

holder from the king and the copyholder the vassal of the Lord of the Manor.

Legislation has, however, now been passed which enables the holder of a copyhold estate to have it made into a freehold. The technical differences between a freehold and a copyhold are numerous, but from the purely economic view they need not be considered at length.

A leasehold in law is said to be an "estate for years," and was originally granted to farmers or husbandmen, either for a definite or fixed period or for the life of the grantor or grantee, in order to encourage them to manure and cultivate the ground to a greater extent than they would if their tenure was of an uncertain nature.

Landlord and Leaseholder

For more than a century, however leasehold estates have been granted for building purposes and also in respect of business premises. It is no uncommon thing for a large land-holder to let vacant land to a builder at a mere nominal rent for a term of 75 or more years on condition that he erects houses of a certain class upon the property. and undertakes to deliver up possession of the property, that is, the land and the houses thereon, at the end of the term.

This system has undoubtedly encouraged building in many ways. On the other hand, it is often contended that the system of granting building leases is responsible for badly built houses. Probably there is good ground for this complaint, as the builder is often a speculator who erects houses for a quick sale.

It is also stated that the leasehold system is unjust, as the leaseholder has not only to give up the land at the end of the term of years, but the buildings which have been erected on it, and the landlord or lessor insists that the buildings have to be in good repair.

The property has probably increased in value enormously during the term, and the landlord takes all these benefits which he has done nothing to create.

It must, however, be remembered that the landlord parted with the possession of his property for a definite number of years, that the improvements have been gradual, and that the lessee has participated in the benefits during the term, that is to say, the holder of the lease, if the property has increased in value, has been able to increase the rental, but the grantor of the lease has to wait until the end of the term, whatever it may be, before he is able to get any advantage from the improvements.

At one time it was quite common to find leases for 999 years at a peppercorn rent or some exceedingly nominal acknowledgment. Such leases were to all intents and purposes a freehold, and can by an application to the Courts be made a freehold under the provision of the Leasehold Enfranchisement Acts.

It has been proposed (and the proposal has found supporters in all the political parties) that all leaseholders should have power to acquire the freehold either by complete purchase, or by substituting a permanent rent-charge for a rent for a term of years.

An alternative proposal has been made, that in cases where the leaseholder wished to purchase the freehold, a purchase clause in the lease could be inserted which would have all the benefits to be derived from enfranchisement and would keep the sanctity of contract inviolable.

The Enclosure Act

The agricultural and rural side of the land problem is the side which, both on economic and ethical grounds, stands in a different relation to the State than any other question.

How is a regular and certain food supply to be ensured to the ever-increasing inhabitants of the United Kingdom who live in a variable climate and whose main supply has to be imported some from our Colonies and some from foreign nations?

Up to the 18th century the greater part of the cultivated land was farmed on the commercial or open-field system, or what is sometimes referred to as common lands system. The inhabitants lived in villages clustered round the various manors.

The principal feature of the villages was that they were self-contained. They neither looked to the outside world for support, nor did the outside world look to them for supply. Trade was internal, food, drink and necessaries were made by the inhabitants.

Each village was a little world to itself and the interest of the community was confined to the immediate surroundings. Nearly all shared in the welfare of the village farm, from the yeoman with his many strips to the cottager with perhaps merely the rights of grazing a cow on the common pasture.

Then came the Enclosure Act.

The open-field system was unproductive. Land was wasted by divisions and footpaths, it was inconvenient to the occupiers, whose holding frequently consisted of half a dozen

strips divided from each other by other people's land, quantities of land were devoted to tillage which were more suited to pasture, and it prevented the introduction of new crops such as potatoes and other root crops.

The population rose rapidly, but the products of British agriculture could not keep pace with the population. It was necessary to increase the home supply, and the best method of doing this appeared to be by abolishing the old strip system or the common land system and to introduce modern and scientific farming.

At first the common land was divided up by agreement, but it was not possible to prevent disputes, and it became the practice to petition the Courts of Chancery, which made a binding order on all parties. Subsequently the practice of going to the Courts of Chancery gave way to petitions to Parliament, and Commissioners were appointed to work out details for the division of the lands among all who could prove any legal rights, either in the cultivated land, or in the land which was grazed in common by the cultivators.

The Lure of Emigration

The most common form of compensation was the allotment of a definite block of land or a money payment.

The policy of enclosure was an inevitable development of agricultural science, and was hastened by Parliament in order to save the country from what appeared to be certain famine.

A great industrial revolution caused a demand for labour, and the Enclosure Acts made the cottager a wage earner, and it was easier for him to leave the country for the more attractive life in the towns. Then came the attractions of the New World.

The agricultural labourer saw prospects of a successful career before him in the United States, and later in Canada, Australia and other countries. The inevitable result was a steady outflow of the countryside population.

In 1811, 35 per cent. of the population was engaged in agriculture, in 1841, 22 per cent., and in 1901, 9·2 per cent. At the last census, only 2,268,454 persons were so employed.

Notwithstanding the fact that the agricultural labourer rushed to the towns for employment, the growth of the enclosures formed a new epoch in the history of agriculture, which benefited to an enormous extent. Landlords invested more capital in their estates, and tenant farmers brought the latest scientific methods and machinery to bear on their operations and more intensive farming was introduced, with the result that output was increased and cost reduced.

The population of the country increased more rapidly than the food supply, and we had to look more and more to other countries, which we have already mentioned, and they began to pour their crops into this country in ever-increasing quantities. Freights for transport became so cheap that it was difficult for the home market to compete even with a good harvest, but with a bad harvest there was distress among the farmers and the smaller tenants went under. Their holdings became absorbed in those of the larger holders who were able to bear the strain better.

Rents were reduced, and in 40 years the income in rent of agricultural land fell by 24 per cent. The result of this has been that there has been a decrease in arable land and an increase in pasture land.

Small Holdings and Allotments

We can now form some idea of the necessity for a reform which will improve the agricultural industry, and the question is, how can we increase the supply of necessities within our own shores—not luxuries—which may be classed as wheat, meat and milk? Some economists suggest that the system of large farms is at the root of the question, and we must now examine the proposals for remedying this, which are small holdings and allotments and small ownership.

The Small Holdings Act was passed in 1892 and gave powers to county councils, where there was a demand for small holdings, to acquire land which came into the market for the purpose of cutting it up into small holdings. In 1907 a further Act was passed, and in 1908 a Consolidating Act which gave the county councils compulsory powers to acquire land for small holdings, to borrow money for the purchase price of the land and its adaptation for small holdings; the rent to be charged to a tenant to be a sum sufficient to cover all the administration expenses and to recoup the council for its initial outlay in 80 years. Some 1½ millions of small holdings and allotments are held in the United Kingdom.

Some of the advocates of other measures contend that the scheme is a failure, the system of fixing rents on the basis of charging the tenant with the administration expenses making the rent too high, and the charge for a sinking fund which will ultimately buy the land for the county council instead of the tenant being unsatisfactory.

The alternative to small holdings is small

ownership. It is suggested that the most practical way to attract the population back to the land is to offer the tenant the greatest incentive, and that is ownership of the land; and that this can be done by means of credit societies and banks and other machinery directed by the State.

That without such secure tenure, co-operation or any other elements of agricultural progress must be absent. A policy which carries with it the magic of ownership offers that fixity of tenure and provides the outlook or incentive which is more urgently required by the labourers than a mere rise in wages.

The various proposals are discussed at great length in the Report of the Land Enquiry Committee, to which we refer the reader for further information.

The two proposals are essentially individualistic, and are condemned by some land reformers, who contend that the only true solution lies in the Nationalisation of land, and that land at the present time is in few hands and is a monopoly.

Peasant Proprietorship

Their arguments are that under the feudal system the ultimate ownership of all land rests in the Sovereign, whose prerogative has now passed to Parliament, and that Parliament should resume possession of all land, and that the State should reap all benefits which have been created not by individuals but by the community.

A system of small ownership called peasant proprietorship has been adopted in France, and the State aid for the purchase of land has proved a success in France, also in Austria-Hungary, Germany, Switzerland, Luxemburg, Norway and Sweden and other foreign countries, and we have an example of ownership under the Irish Land Purchase Acts.

The subject, however, is one which is of the greatest importance to the nation, and, while it presents difficulties and will interfere with established rights and customs, is an economic factor which must sooner or later be faced and solved.

The nation depends on the soil for the production of the necessities of life, therefore it is a subject of vital interest to every class in the community and demands most careful consideration. During the trying years of the Great War (1914–1918), this fact was acutely realised by county, urban and rural authorities, and thousands of allotments were laid down on public parks and commons in the vicinity of large towns.

J. W. U.

ETHICS.—III

It should never be forgotten that the study of Ethics is essentially practical, notwithstanding the fact that it deals with the spiritual side of life. When dealing with the early days of existence it is at its simplest, as it could not fail to be, if it is to contain all the elements of truth.

As the child grows older the circumstances of its life grow more complex, and the study of Ethics has no choice but to follow suit, unless it would suffer from the reproach of falling behind the times.

Knowledge Supreme

The first beginning of the acquirement of *Knowledge* stands as one of the most important milestones in the existence of mankind. With the acquirement of knowledge instinct gives way to *conduct*, and little by little the actions prompted by nature give place to deeds which are the fruit of training and reflection.

As, however, it is not intended that the material side of man should ever be absent in all its forms in the life on earth, the force of instinct does not depart entirely. Not only does it endeavour to persist in its original form, but it gives birth to other forces. Thus *Impulse* is considered to be derived direct from instinct.

Impulse is natural to the child, and to the savage, who, after all, is little beyond a child from the day of his birth to the day of his death, for the reason that he has never had the opportunity of developing his mentality. Impulse represents a distinct advance on instinct, for the former can be brought into being by circumstances which could have no effect whatever on the latter. Impulse, for instance, might urge a man to leap into the water in order to save a drowning person. But mere instinct is largely concerned with *self*-preservation. The peril of another would not have the power to stir it into action, and any such circumstances, in fact, would leave it profoundly unmoved.

Notwithstanding the fact that impulse may lead to the most meritorious actions, it must be looked upon as merely a transitory stage in the spiritual progress of man. It must not be thought from this that it is intended that man ought to shake himself free from impulse, and must refrain from attempting to rescue his endangered fellow human-beings on that account. Such a transition, of course, would denote a backward step instead of a forward one, and therefore would be directly against the

ordained order of things. It is merely that a man, when urged to do an action, however noble and self-sacrificing it may be, should not be dependent upon impulse alone for his motive. He is in need of a more substantial and thoughtful background for his deeds.

Here we are brought to the next step in the spiritual progress of mankind. From impulse, going up the scale again, is derived *Desire*. It is at this stage that the question of training becomes of the acutest importance. Before we leave the subject of desire we may survey some of the most marked strides in the spiritual progress.

In a properly trained person the types of desire should undergo a transformation with increasing years. This is easily explained by a comparison of the desires of childhood and manhood. A child will want something because it looks pretty. It will want a brightly-coloured object because it catches the eye. It longs to clutch it and handle it, and the longing is for the possession pure and simple.

Evolution of Desire

From this stage the youngsters are not long in emerging. The boy desires to be top of his class merely for the pride of place, it is true; but in other directions he can look already beyond the immediate whims of the moment. He desires a cricket bat, not because its colour and shape appeal to his eye; but in order that he may make runs with it. In the same way, a small girl cherishes a doll, not necessarily because it is pretty in the least, but in order that she may pretend that it is a child and that she is its mother, and that she may nurse it and look after it in the accepted way.

Neither of these instances, it is true, suggests any marked heights in moral and intellectual progress. But they do at least show a clear advance from the stage of impulse. And as a man approaches maturity, this advance should become still more marked. A properly trained man should desire no object whatever as an *end in itself*. A man, for instance, who longs to be Prime Minister does not do so for the mere hollow fact of *being* Prime Minister. He desires the post for the opportunities it will give him of doing great acts.

Even the man, the motives of whose work are purely mercenary, acts from similar motives. The hoarder of money does not accumulate the coins for the simple reason that they are yellow and shining, or the banknotes because their paper is crisp and rustling. By no means. He hoards the money because he realises the material power its possession gives him, and because he knows that as soon as he parts with his cash he parts with this power. He retains it, therefore, not because of the intrinsic charm of its possession, but because he realises its value as a reserve force.

In this case, of course, the motives are to be deprecated. Nevertheless the action, though false, must be classed as an intellectual one, in a sense.

It will be obvious from all this how necessary it is to train desire in the right way. Impulses live for a few seconds, and are gone. Desires remain, and it is from these that spring some of the most praiseworthy ambitions. The importance of these is too obvious to need any comment here.

The Complex of Emotion

We may now deal with another factor in human life which in a way is very closely akin to desire, since it is also a product of instinct. This is *Emotion*. Emotion is a complex factor, but it is clear that all its different manifestations have been derived in the first place from the primal instincts such as those of anger, fear, and the rest.

Emotion has been termed the salt of life, and it is perfectly certain that life without emotion would be inconceivable. It has this in common with desire, that it is capable of being educated from its crudest forms to something very beautiful. The power has been given to humanity to cultivate its emotions just as a gardener draws a glowing patch of blossom from out of the bare brown earth.

In the matter of desire we have already said that a child and a savage were on the same plane. The same remark applies to emotion. The emotions of a child or a savage will run riot—like rank weeds, we may say, while those of a civilised person will exhibit the symmetry and trained charm of a carefully cultivated rose.

It should be ever borne in mind that emotion should never be repressed. The repression of emotion is almost certain to bring about an unhealthy condition of affairs. To dam up its current, in fact, is to run the risk of imparting a brooding side to a temperament that, perhaps, would never otherwise have suffered from this disadvantage.

Among the various forces placed at the disposition of humanity, even emotion, important though it is, does not represent one of the final stages in these various roads of

progress which we are endeavouring to point out. The tendency, as will already have been evident, is in every case to strengthen, to solidify, and to make towards a lasting and definite state.

Thus emotion follows the general rule, and permits its power to be promoted, as it were, to a firmer state. By this step we come to the stage of *permanent sentiments*. Sentiments are of far greater importance than emotion—for much the same kind of reason that an oil painting exceeds in value the scrawled sketch on a slate which can be rubbed out in a moment.

In referring to these comparative values we are speaking now, of course, of mere force, for it by no means follows that all these sentiments are for the benefit of humanity in general. We know only too well that they are not. Moreover, various sentiments may clash in the one personality. Thus, affection for another may contend with self-love; the force of avarice may find itself opposed to that of patriotism, and so on. It is the varying nature of these sentiments in a single personality which is responsible for the chief difficulties in the study of human nature, and which is apt to confuse those who look for rigid uniformity and a machine-like precision in the conduct of men.

Sentiment is Conservative

It is an undeniable fact that a sentiment, once formed, is difficult to change. It is a powerful thing. The emotions of a child resemble a light wind-vane that swings round to the influence of every passing air. The sentiments of a man are like a ponderous doorway that only moves reluctantly to great and persistent pressure—sometimes, too, the rust will be found to have eaten into the spring, and the door will sooner fall to the ground and have done with its existence than be moved.

We have now followed the forces derived from instinct through their various phases. We have seen how instinct gives birth to impulse, and how impulse may resolve itself into desire. We have seen, too, how another product of instinct, emotion, leads the way to permanent sentiment. And now, in order to complete the set of forces which are at work in this corner of life's great stage, we have to deal with another.

This is *Action*. Action is essential in moral progress. Without it everything would lie fallow—impulse, desire, emotion and sentiment. A man may desire to do the right thing, and his ambition may point in the proper and lofty direction. But without action all these forces are in a sense neutralised.

By action may be implied conduct, and it is conduct which gives the key to character. After all, there is no other channel by which the merits or demerits can be manifested. It is clear that character determines conduct; but the influence is mutual, and it is equally certain that conduct determines character. That is to say, that when character has been raised to a level which results in good deeds, the influence of these deeds reflects back on the character and strengthens it still more.

Man, a Free Agent

We have said already that man is a free agent, and that he is therefore responsible for every one of his actions. This responsibility is heavier than many realise; for it is not given to everyone to reflect on the extraordinarily far-reaching nature of every act. One openly brutal deed will do more than serve as a mischievous example to hundreds. Its direct results are instructive in their range, but somewhat appalling to contemplate. It is by no means out of the question, for instance, for a criminal who strikes a woman, and injures her seriously, to cause physical affliction to her offspring, who pass it on in turn, and thus in the end to bring sorrow to many hundreds of people.

This instance, of course, is a crude one, but it may serve its purpose in demonstrating the great concatenation of links which attend the actions of mankind. The social world in this respect is like a clear pond. Fling a stone into it, and the ripples will flow across every inch from the centre to the edge. In fact, to alter the simile rather abruptly, it is right that man should remember that, so far as his social situation and duties are concerned, he is a piece of a jig-saw puzzle, and should he fall the pattern of the whole cannot be complete.

The importance of the ethical and moral problems to which this lesson gives rise, and of which the philosophers of every age have attempted solution, may be summarised as (*a*) the source of the moral sense in man; (*b*) the quality of those inner motives which incite and direct action as displayed in conduct at the bidding of the moral sense; (*c*) the object, purpose and end which man tries to attain by the exercise of moral actions; (*d*) the final standards of measurement by which such endeavours are judged, and by which they are controlled and directed.

W. H. K.

Continued from page 260.

HISTORY:

Contributors:—**J. A. Brendon, B.A.(Oxon.), F.R.Hist.S.; F. Collinson, F.R.Hist.S.; T. P. Evans, B.A.(Oxon.); James A. Manson; L. Stampa, M.A.(Oxon.); and J. B. Sterndale-Bennett.**

THE UNITED STATES OF AMERICA, 1783—1914

WHEN Lord Cornwallis surrendered to Washington at Yorktown on October 19, 1781, the American colonists really gained the object for which they went to war with the mother country.

A provisional treaty of peace was signed on November 30, 1782; and, after the close of negotiations with France and Spain, the allies of the Americans, the final treaty was concluded on September 3, 1783.

Independence Recognised

This instrument definitively recognised the independence of the United States —the thirteen original or founder States being Delaware, Pennsylvania, New Jersey, Georgia, Connecticut, Massachusetts, Maryland, South Carolina, New Hampshire, Virginia, New York, North Carolina, and Rhode Island.

Other conditions stipulated that Congress should recommend the various States to protect the interests of the Loyalists; threw open the navigation of the Mississippi alike to Britain and the States, and gave the latter the right of fishery on the Newfoundland Banks and the Gulf of St. Lawrence, and the right of drying on any unsettled territory.

With peace came trouble to the young Union. Each State had its own bicameral legislature, whose rights and privileges were jealously guarded.

The lack of a powerful central body competent to control matters of common necessity—such as commerce, defence, finance, and the maintenance of the general authority—soon became painfully evident. The Articles of Confederation had tided the States over the crisis of the Seven Years' Conflict, but now fell into more or less desuetude. Paper money, which had been issued in the most reckless manner, was now worthless; bankruptcy seemed imminent, and it appeared as if the disintegrating forces at work might dissolve the Union itself.

Reform of the Articles from within was impossible, since the veto of a single State sufficed to block the way, and at least one State had always been equal to this unpatriotic rôle. The threatened paralysis had exercised many of the greatest minds, but for some years every effort to compass a drastic change proved abortive. At last Congress was induced to summon a convention for the sole purpose of revising the Articles and of reporting to Congress and the several States.

The first session was held, under Washington's chairmanship, in Independence Hall, Philadelphia, on May 25, 1787. The delegates tacitly ignored the Articles and started with a clean slate, and, after four months' hard labour, the convention, mainly as the result of numerous compromises, agreed to recommend the present Constitution to Congress, and this body unanimously resolved (September 28) to submit it to the State legislatures, with the proviso that unless it were ratified by nine States it should lapse.

Constitution of the U.S.A.

The States did not hasten to ratify, but the alternative of Disunion compelled a reluctant assent in favour of a settled national government.

According to this, its fundamental Constitution, the government of the United States consisted broadly of three functions—legislative, executive, and judiciary.

The Legislative was provided by two chambers of Congress—a Senate composed of two senators from each State elected for six years by popular vote, and a House of Representatives of one or more members (the number depending on the previous census) from each State, chosen every two years by the people in equal electoral areas.

The Executive comprised a President,

elected for four years with the right of re-election, and a Vice-President, who was to act as President of the Senate; while the Judiciary comprised a Supreme Court and district judges. The States retained their own legislatures, but conferred upon Congress extensive powers in all matters of common national interest.

This "written" Constitution is not easy of amendment, but can be, and has been, amended by a convention at the call of two-thirds of the States, or by a vote of two-thirds of Congress ratified by three-fourths of the States.

George Washington

George Washington, of Virginia, was elected first President of the United States (1789–93), with John Adams, of Massachusetts, as Vice-President. His main concern was to consolidate the national affairs and to set the machinery of government in motion. Four departments were already in being—Foreign Affairs (or State, as it was afterwards called), Treasury, War, and the Post Office—and these were headed respectively by Thomas Jefferson, of Virginia; Alexander Hamilton, of New York; Henry Knox, of Massachusetts; and Samuel Osgood, of Massachusetts. The office of Attorney-General was established and assigned to Edmund Randolph, of Virginia; and John Jay, of New York, became Chief Justice.

Though the Constitution had not expressly provided a Presidential Council, this, in practice, was seen to be necessary. Occasionally Washington had sought the written opinions of the three Secretaries and the Attorney-General, but this cumbersome plan was replaced by informal meetings for deliberation at more or less frequent intervals. By 1793 this custom was regarded as the regular procedure, and the Council was termed the Cabinet.

Party troubles were not unknown. The Federalists, the forerunners of the Republicans of to-day, stood for national as against State rights, which were strenuously upheld by the Republicans, of whom the present Democrats are the lineal descendants.

Still, domestic affairs were so urgent and so grave that Washington's first term was passed without serious contention. During his second period (1793–97), which witnessed the admission of Tennessee into the Union, however, he was hard pressed to steer evenly between Great Britain on the one hand and France on the other, now entering upon their war *à outrance*. Washington's policy of neutrality was, in the circumstances, the soundest for the nation, although contrary to the letter of the treaties made with France in the War of Independence; but it was bitterly opposed by Jefferson and others.

Neither of the European Powers was blameless, as each had confiscated American cargoes in a high-handed way, but John Jay's treaty (1794), while it partly adjusted matters with the British, exacerbated the French. Weary of the partisan squabbles, and doubtless alive to the danger of bringing about a condition of things in which new President should only be old King writ large, Washington declined a third term, in a dignified farewell address, warning the people against discord and party spirit. Whether devised or not as a safeguard against monarchy, Washington's precedent has been strictly followed, and no President has served for more than two terms.

John Adams, elected second President (1797–1801), found himself embroiled with France, which had declined to receive Charles Cotesworth Pinckney as minister. The people were hot for war, and Washington emerged from his retirement to assume the command-in-chief of the army. Beyond a few minor engagements at sea, however, hostilities were avoided.

The treaty of peace concluded with Napoleon on September 30, 1800, provided for the mutual restoration of vessels and goods not yet condemned, and established the maxim that, save in the case of contraband, "Free ships make free goods."

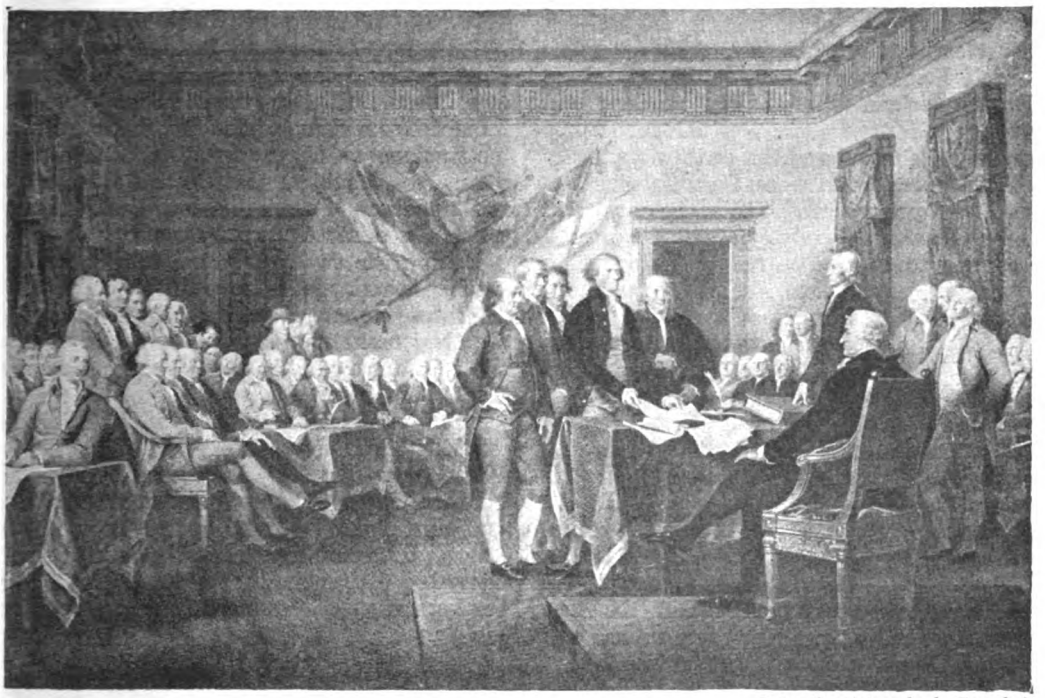
Napoleon and President Jefferson

The menace of war had left its mark in the creation of the Department of the Navy (1798), the passing of the Naturalisation, Alien, and Sedition Acts, aimed at French sympathisers, and a tax on houses, land, and slaves—the first direct tax ever imposed in the United States.

Despite his high character, Adams's attitude towards the French had alienated many, and he failed to obtain a second lease of power, Thomas Jefferson becoming third President (1801–5).

A Democrat by precept and practice, Jefferson considered that that government was best which governed least, and throughout his dual term (for he was re-elected for 1805–9) attempted to act in accordance with this principle.

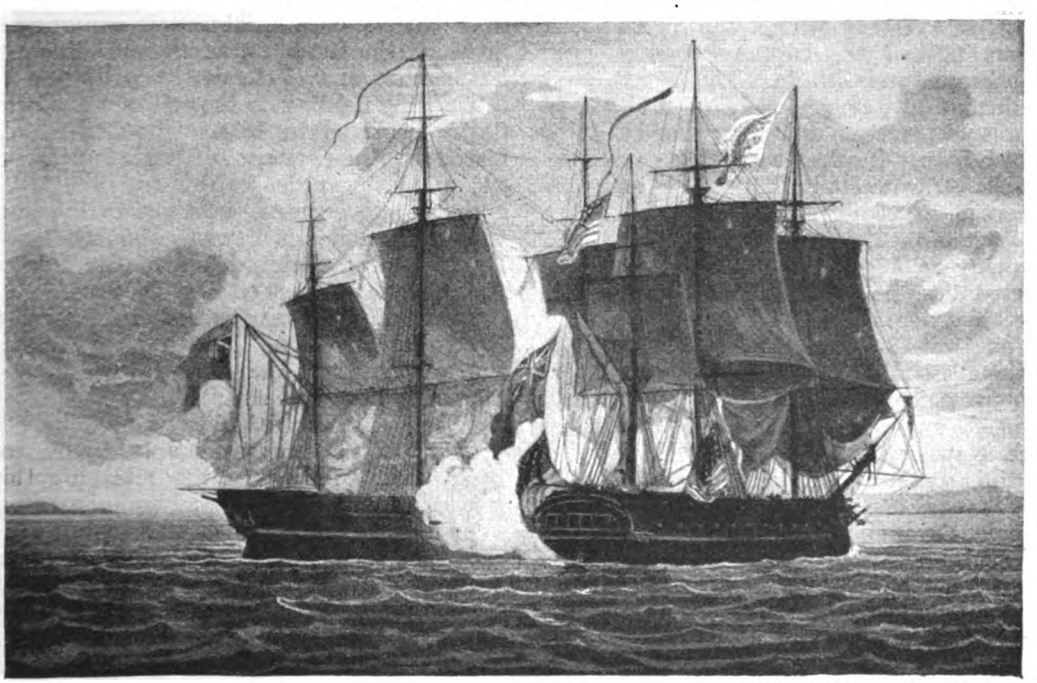
Jefferson's rule was famous for the purchase of Louisiana. Originally it belonged to France, which ceded it to Spain by the Treaty of Paris (1763), but Napoleon had procured its retrocession in 1800—in pursuit of his



From the picture by J. Trumbull.

THE DECLARATION OF INDEPENDENCE

was formally declared on July 4, and signed on August 2, 1776. At the beginning of the war comparatively few Americans really wished for independence; the desire was largely fostered by the refusal of George III. to listen to the petition of Congress and by his employment of German troops.



After the painting by T. Whitcombe.

THE DUEL BETWEEN H.M.S. *SHANNON* AND THE *CHESAPEAKE*,

which resulted in the capture of the American ship, is one of the few incidents worthy of note in the war between Britain and America (1812-14).

grandiose scheme of universal empire—on the understanding that it should revert to Spain if France ever gave it up.

But American settlers and traders had grown very restive under Spanish suzerainty over the Mississippi and the waterways to the Gulf of Mexico ; and when New Orleans was closed to American trade, this was construed as a hostile act, not only to arrest the growth of commerce, but also to prevent further expansion westwards. Feeling throughout the United States at once burst into flame, and Jefferson opened negotiations for the purchase of West Florida from Spain and New Orleans from France.

Napoleon would not hear of the deal at first, but the collapse of his designs in San Domingo and his need of money tempted him and he fell.

Spain protested that the transaction violated her treaty rights, but when King Charles IV. learned that he would have to fight for them he climbed down. Part of the area was delimited and named Louisiana, and admitted into the Union as a State in 1812.

War with Britain

It soon appeared that the Napoleonic struggle would precipitate a collision between Great Britain and the United States. America's commerce had prospered amazingly, and her carrying trade in European waters nettled the captains courageous of both France and Britain. The latter Power conducted a stringent right of search, and impressed American sailors suspected of being British-born, besides capturing numerous vessels. Theoretically only deserters were supposed to be detained, but there was a shortage of men, and between 1796 and 1802 as many as 1942 Yankee sailors were impressed into the British Navy on the plea that they were deserters.

The United States, for its part, had not the smallest inkling of the nature of the contest in which the European coalition was plunged, and indeed seemed to sympathise with Napoleon. When James Madison, of Virginia, was elected President (1809–13) no change of policy occurred, and, on Napoleon's announcing (1810) that his decrees were suspended as against the United States, the latter—not curious to consider whether the Emperor could carry out any of his naval programme—intimated that commercial intercourse with Great Britain must cease unless her Orders in Council proclaiming the blockade of Belgium, Holland, and Germany, and the closing of neutral ports, were withdrawn.

In the following year the defeat of the British sloop *Little Belt* by the American frigate *President*, and the victory of the Americans over Tecumseh (who was alleged to have fomented the rising of the red men at British instigation) at Tippecanoe, in Western Indiana, so delighted the United States that nothing short of a miracle could now prevent war. No miracle happened.

During the two years and a half that the conflict lasted, the Americans invaded Canada on three separate occasions, but not once did they make any real headway, in spite of the inefficiency of the British commander-in-chief, Sir George Prevost.

Michigan fell into the hands of the British in 1812. Next year the Americans captured York (now Toronto), establishing a slight hold on Upper Canada ; and in 1814 several stubborn fights took place on or near the Lakes, in which neither side gained much advantage, though at Plattsburg, on Lake Champlain, the Americans won a decided victory.

H.M.S. *Shannon* v. the *Chesapeake*

At sea, to the general surprise, the United States carried all before it in 1812, her privateers even venturing into British waters. In the following year, however, they lost heavily, and the duel between the American *Chesapeake* and the British *Shannon* (June 1), in which the latter captured her adversary, has become a naval classic.

The only fighting on the soil of the United States occurred in 1814. The British defeated the Americans at Bladensburg (August 24) and afterwards set fire to the Capitol and other government buildings in Washington, an exploit which was counterbalanced by the overwhelming defeat of Sir Edward Pakenham's attempt on New Orleans.

Terms of peace were settled at Ghent, on December 24, 1814, through the intervention of the Tsar Alexander I., whose good offices Madison had solicited.

When the campaigning was over, the peopling of the immense tracts beyond the back lands and across the Mississippi increased both in volume and momentum.

As long as locomotion was confined to caravans, pony expresses, and overland coaches, the rate of advance was comparatively moderate, but after the trunk railways were laid down East and West joined hands and the wilderness blossomed like the rose, countless miles of virgin soil smiling under dense crops of golden grain.

While this immigration was in its infancy, James Monroe, of Virginia, had been elected

fifth President (1817–21) and was honoured with a recall (1821–25). His rule became celebrated for divers reasons. Negotiations, tempered with pressure, induced Spain in 1819 to part with Florida (which, however, did not reach Statehood until 1845), and the admission of Missouri raised the question of slavery in challenging shape. The "domestic institution" had once existed in all the States, but was now extinguished in the northern (or eastern) States and in all the middle States except Delaware. The southern were solid for slavery, and of the western States three (Ohio, Indiana, and Illinois) were for freedom and two (Tennessee and Kentucky) against. At this date (1821), then, there were twelve free States and eleven slave. The free States were industrial and Protectionist, and the slave States agricultural and Free Trade. Whenever any new State was added to the Union, therefore, its leanings were of vital importance.

The Monroe Doctrine

When it was proposed to admit Missouri as a slave State, prodigious excitement was caused, and allayed only by what was called the Missouri Compromise. By this, slavery was prohibited (save in the new State) north of the parallel of 36° 30′. But what brought worldwide fame to Monroe was the enunciation of the Doctrine which has since been coupled with his name, in his message to Congress on December 22, 1823.

The Monroe Doctrine may be popularly defined as "America for the Americans." It was feared that Russia might encroach down the Pacific coast from Alaska (Russian by right of exploration), and that Spain might try to recover her lost lands. Monroe accordingly affirmed that, while the United States had no desire to entangle itself in the affairs of the Old World, no foreign Power could be allowed to colonise on the American continent, that the United States would take no part in European politics, and that European interference with any American State whatever would be regarded as "dangerous to our peace and safety," and would not be tolerated. This Doctrine has been accepted as applying to North and South America, and to islands within the danger zone, such as Cuba, Hawaii, and the Philippines. It was enforced in 1865 against Napoleon III.'s dynastic projects in Mexico, and, in 1895, when Great Britain was involved in a boundary dispute with Venezuela.

John Quincy Adams, of Massachusetts, son of the second President, was elected sixth President (1825–29). His tenure was chiefly distinguished by the growth of rancorous party spirit, which prevented him, like his father, from enjoying a second term. The Democrats opposed him and secured the return as seventh President of General Andrew Jackson, of Tennessee (1829–33). Jackson's repulse of Sir Edward Pakenham, and his victories over the Southern Indians in Florida, had rendered him popular, and he was eagerly re-elected (1833–37).

He was in frequent conflict with the Senate, but his Scottish blood and army training made him a hearty fighter. His administration was notable for the institution of the Spoils System ("To the victors the spoils"), which awarded office for party service, irrespective of tenure or merit, and incidentally went far to degrade the Civil Service.

President Jackson

As an old soldier, Jackson stood for discipline. He risked, therefore, a quarrel with Vice-President Calhoun, when the latter pushed the doctrine of State rights to its utmost limits. The high Protective tariff hit the South very hard, and South Carolina declared the Act imposing it unconstitutional, threatening secession if it were enforced. Calhoun maintained that any State might annul an Act of the Federal Government, and, when Jackson prepared to employ force, resigned office.

Jackson did not scruple to exercise his veto on another financial subject. The charter of the United States Bank was to expire in 1836, and he vetoed the Bill granting re-charter, declaring that Government moneys should be kept in State banks in future. The "removal of the deposits" led to an undesirable increase in the number of these institutions, the capital and reserves of which did not warrant the responsibilities they so lightly assumed. A widespread panic ensued. Banks suspended payment. Trading was gravely jeopardised. This not only enhanced the anxieties of Martin van Buren, of New York, who had been elected eighth President (1837–41), but destroyed his chance of re-election, though his proposal of an independent Treasury was adopted in 1846, when an Act was passed providing for the keeping of public funds in mints, custom-houses, and sub-treasuries in a few large cities, and for the payment of public dues either in specie or Treasury notes, thus excluding bank notes.

Van Buren was succeeded by General William Henry Harrison, of Ohio, as the

ninth President (1841), amidst scenes of unparalleled excitement. The new President, however, died within a month of his inauguration, and the Vice-President, John Tyler, of Virginia, constitutionally became tenth President (1841–45). A complicated issue was ready to his hand. Land to the west of the Sabine had been ceded to Spain in exchange for Florida, and largely colonised (with ulterior aims) by southern slaveholders between 1820 and 1830, when Mexico forbade further American settlement.

The settlers' claim to be admitted as a separate State of Mexico having been rejected, they rose in rebellion, defeated the Mexicans at San Jacinto in 1836, and proclaimed the Texas Republic, with General Sam Houston as President. Next year Texas applied for entry into the Union, but formal annexation was opposed by van Buren and eight States.

As Texas would be a slave State, the southerners at once started a keen agitation in favour of its admission, and, to conciliate the western States, advocated the sole occupation of Oregon, since 1818 jointly occupied up to 54° 40′ N. by the United States and Great Britain.

War with Mexico

The bait took, and a joint resolution of both Houses—a device of doubtful legality adopted to circumvent the resistance of the Senate—sanctioned the annexation on March 3, 1845, and Texas was forthwith admitted.

James K. Polk, of Tennessee, who had been elected eleventh President (1845–49), was an avowed annexationist and ready for the war which Mexico had warned the United States would be inevitable. A trifling advantage over some American dragoons at Matamoros (April 24, 1846) was the only success the Mexicans met with. After numerous engagements, the chief of which was Zachary Taylor's brilliant victory at Buena Vista on February 23, 1847, the Americans entered Mexico City on September 14.

By the treaty of February 2, 1848, Mexico gave up California and New Mexico, and recognised the Rio Grande frontier of Texas, in return for fifteen million dollars and the assumption by the United States of the claims—amounting to three and a quarter million dollars more—made by American settlers for loss of property in the recurring Mexican revolutions.

This big haul gave the United States what are now California, Nevada, Utah, Arizona (north of the Gila), and parts of Wyoming, Colorado and New Mexico.

The notice to terminate the joint occupation of Oregon seemed likely to entail trouble with Great Britain, but any prospect of war vanished when Britain offered, and the United States accepted, the parallel of 49° N. as the boundary line. The Union was further enlarged by the entry of Iowa as a State in 1846, and of Wisconsin in 1848.

Whatever may be thought of the ethics of the transaction, the acquisition of California was infinitely profitable, since it contained the potentialities of mineral, fruit, and agricultural wealth far beyond the dreams of avarice.

Slavery was fast growing to be the crucial issue, was dividing the Union into two hostile communities—South *versus* North—and threatening its very existence.

The Question of Slavery

Ever since the old Colonial days man's property in man had been intensely repugnant to many of the inhabitants, and in course of time the opposition began to organise itself.

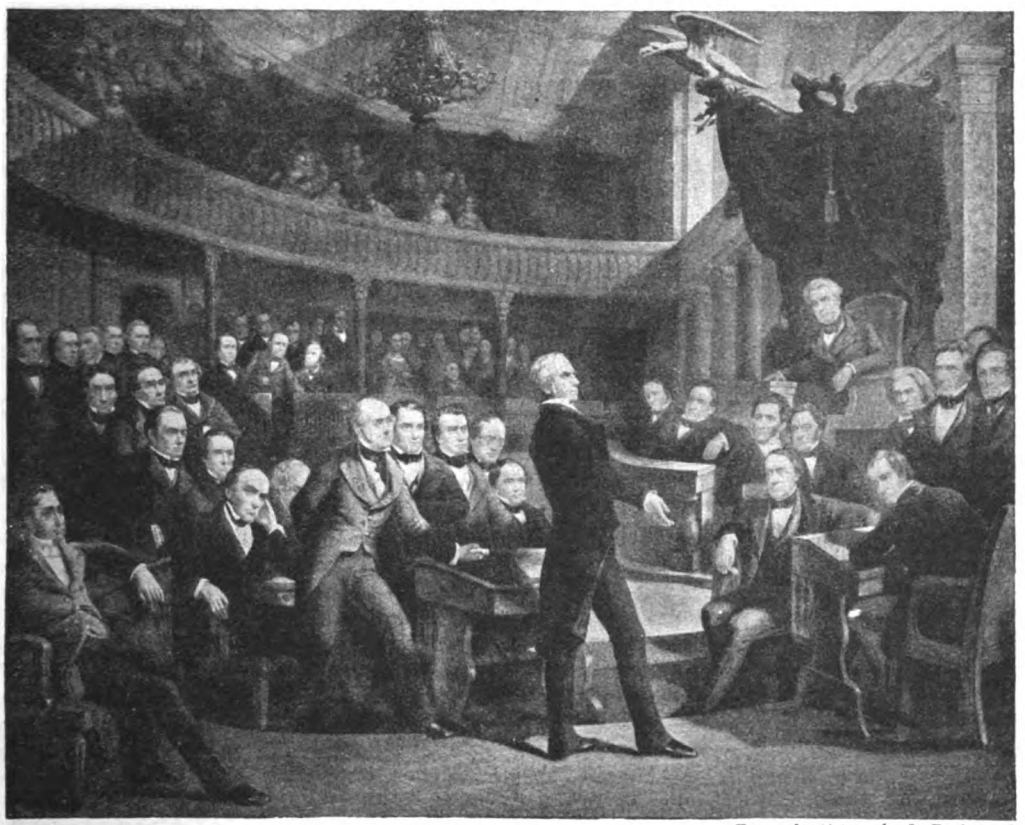
In 1846 and 1847, while the Mexican campaign was in progress, David Wilmot, of Pennsylvania, introduced the Proviso that slavery must not exist in any land that might be acquired by the war. This was twice carried in the House of Representatives and twice rejected by the Senate. Nevertheless it became a plank in the Republican platform.

In 1850 came Henry Clay's Compromise Bill, which events soon made largely obsolete, for it merely stipulated: (1) that California should be a free State; (2) that the people of New Mexico and Utah should settle whether they were to be bond or free; (3) that Texas should receive ten million dollars in satisfaction of her claims against New Mexico; (4) that the slave trade should be abolished in the District of Columbia; and (5) that a more efficient Slave Law was needed.

Inadequate as this measure was, it had the hearty support of Millard Fillmore, of New York, who was then President (1850–53), and of President Franklin Pierce, of New Hampshire (1853–57).

In truth, the time for further compromise had gone. The cruelty of the laws dealing with the return of fugitive slaves only added fresh fuel to the controversy, which raged, if possible, more furiously than ever when the Kansas-Nebraska Bill was passed in 1854. Under this Bill, which *de facto* repealed the Missouri Compromise, the people in these Territories (as they were then) were to decide whether they would have slavery or not.

The immediate effect of the Act was to plunge Kansas into internecine strife. Public opinion had been stirred to its depths by the publication of Mrs. Beecher Stowe's *Uncle Tom's Cabin*, which had an immense circulation on both sides of the Atlantic; by the Dred Scott decision of 1857, which denied the negro his natural rights as a human being, and declared that a slave captured in a free State must forfeit his liberty; and by the hanging of John Brown, an anti-slavery zealot who had attempted (1859) forcibly to free the negroes at Harper's Ferry on the Potomac.



From the picture by J. Rothermel.

THE UNITED STATES SENATE IN 1850.

Henry Clay proposing the Compromise by means of which he hoped to allay the growing agitation on the vexed question of slavery.

With the advent of James Buchanan, of Pennsylvania, as fifteenth President (1857–61) a final attempt at conciliation was made, but nothing could stay the headlong career of the planters. Instinctively they felt that the hour for action had struck when Abraham Lincoln, of Illinois, was elected as sixteenth President (1861–65).

Secession, the South iterated and reiterated, was the inalienable constitutional right of every State in the Union, and it carried this conviction into effect during the winter of 1860–61 with a promptitude which spoke of thoroughly matured plans. The seceding States comprised South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, Texas, Arkansas, North Carolina, Virginia, and Tennessee. They had a population, including three and a half million slaves, of nine millions, while the Union numbered twenty-two millions. They assumed the title of the Confederate States of America, elected Jefferson Davis, of Mississippi, President, and Alexander H. Stephens, of Georgia, Vice-President, set up the normal machinery of government, and chose Richmond, Virginia, as their capital.

Slavery had provoked war; maintenance of the Union rendered it imperative. The Confederates took the fatal step by firing on Fort Sumter, in Charleston Harbour, on April 12, 1861. For four years hostilities

by land, river, and sea went on, the battles being often the scenes of sickening slaughter, but in the end the Union triumphed. The Confederates were worn down, both in men and materials, and the last of their generals surrendered on April 26, 1865. They held their own until the loss of Vicksburg (July 4, 1863) and the defeat at Gettysburg (July 1 to 3, 1863), and in "Stonewall" Jackson (mortally wounded by mistake by his own men at Chancellorsville, 1863) and Robert E. Lee, their commander-in-chief, had generals of transcendent ability.

The Union had men, money, and sea-power, but its generals were outclassed in the earlier campaigns. At last, however, the iron resolution of Ulysses Simpson Grant, who was placed in command of all the Union forces in 1864, the resourceful strategy of William Tecumseh Sherman, and the dashing cavalry work of Philip Henry Sheridan not only retrieved the fortunes of the Union, but precipitated speedy and complete victory.

The Confederate losses were never known, but have been estimated at 300,000, while the Union, on a conservative estimate, lost 316,000.

Abolition of Slavery

On December 18, 1865, were added to the text of the Constitution these memorable words: "Neither slavery, nor involuntary servitude, except as a punishment for a crime whereof the party shall have been duly convicted, shall exist within the United States, or any place subject to its jurisdiction."

Lincoln was called by acclamation to a second term, but did not live to behold the vindication of his policy. He was shot in a Washington theatre by an actor named John Wilkes Booth on April 14, 1865, expiring next morning, six weeks after his re-election; and William H. Seward, of New York, the Secretary of State, was also dangerously wounded by an accomplice.

This deed brought Vice-President Andrew Johnson, of Tennessee, to the chair as seventeenth President (1865–69).

After the conflict the country was face to face with many grave problems. The public debt stood at £570,000,000. Industries, dislocated by the war, were still further disturbed by the return of nearly a million men to the pursuits of peace; and the future of the States recently in revolt preoccupied Congress.

Lincoln was disposed to treat the Confederates as naughty children, who, having been licked, might be taken back into favour on security for good behaviour. Charles Sumner held that they had forfeited their status and lapsed into the stage of Territories again. Thaddeus Stevens argued that, having been reduced by conquest, they must be dealt with accordingly.

Unhappily the sullen South exasperated public opinion by continued persecution of the negro, not unmixed with petty despotism, and this paltry passion retarded the work of reconstruction. For a period the South was placed under military government, but Congress gave the disaffected States the option of reinstatement on their adopting new Constitutions, ratifying the three war amendments of the Constitution of the United States. The first has already been cited. The other two safeguarded the negro's citizenship and vote.

The *Alabama* Incident

By 1870 all the seceding States had returned to the fold. The restoration had been complicated by the obstinacy of President Johnson, who thought the difficulty could be handled without the aid of Congress, and who, in one particular, escaped impeachment only by an insufficient vote of the Senate.

His successor, General U. S. Grant, of Illinois, who was elected eighteenth President (1869–73) and re-elected (1873–77), was more amenable, and a settlement was accomplished.

Arising out of the war came the claim against Great Britain for compensation for the ravages of the *Alabama*, a Confederate privateer built and equipped in England. Happily the case went to arbitration, and the Court, at its final meeting in Geneva, on September 14, 1872, cast Great Britain in damages to the amount of £3,100,000. In the same year the German Emperor William I., chosen arbitrator in another dispute between the same countries, decided that the boundary line between Vancouver and the United States ran down the Haro Channel and not the Rosario Channel, and so the Union gained the San Juan archipelago.

The reference of disputes between two great Powers in the world to peaceful arbitration was hailed with universal applause as setting an example fraught with far-reaching consequences.

The Union had increased politically by the admission of Nevada (1864), Nebraska (1867), and Colorado (1876), and the purchase (1867) from Russia for £1,440,000 of Alaska, which became a Territory in 1912. The United States, however, underwent grave

anxieties from a monetary panic in 1873, which occasioned prolonged industrial depression. The crisis was accentuated by the demonetisation of silver and the opening up of fresh supplies of the metal, a discovery which encouraged the bimetallists to embark upon a pertinacious crusade. But the marvellous recuperative powers of the country worked healthily under Presidents Hayes (1877-81), Garfield (assassinated in 1881), and Arthur (1881-85). In 1885, Grover Cleveland, of New York, became President.

Cleveland directed his policy mainly against the high-walled tariff, and to strengthen the farming interest, now of supreme importance.

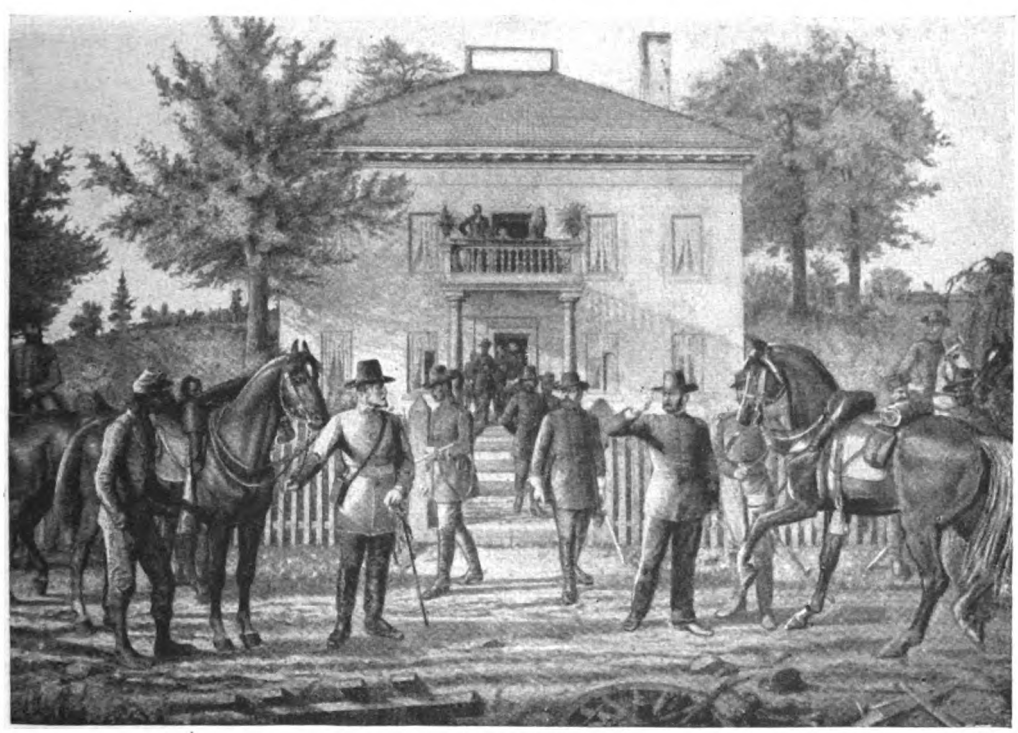
Cleveland failed of re-election, and was succeeded by Benjamin Harrison, of Indiana, as twenty-third President (1889–93). But Cleveland was again elected in 1893.

Differences had arisen in 1895 as to the boundary between British Guiana and Venezuela, and, the latter having cunningly invoked the protection of the United States, Cleveland pronounced that the issue came within the purview of the Monroe Doctrine. In spite of provocative journalism, the matter was amicably settled in 1897.

The President was not so well disposed towards another small outlying Power. After a revolution in 1893 the Hawaii Islanders, who had been friendly with the United States for many years, asked to be annexed. Their request had been agreed to by Harrison, but not ratified, and now Cleveland withdrew it.

In William McKinley, of Ohio, the twenty-fifth President (1897–1901), the Republican party found a full-blooded Protectionist, who consented to the annexation of Hawaii (1898), which was constituted an Island Territory two years later.

McKinley had a more delicate proposition to negotiate with another island. The condition of affairs in Cuba had grown intolerable. For several years an insurrection had raged in which neither Spain nor the rebels could obtain the mastery. Meanwhile the commercial interests of the United States had suffered so heavily that the Union had no alternative but to intervene, and Spain was accordingly asked to terminate the misgovernment and lawlessness. She refused to recognise the right of America to interfere, and the gravity of the situation was aggravated a thousandfold when, just at



THE SURRENDER OF GENERAL ROBERT E. LEE (April 9, 1865)

to General Ulysses S. Grant at Appomattox brought to an end the sanguinary and long-drawn-out civil war between North and South.

that moment, the United States battleship *Maine* was destroyed (February 15, 1898) in the harbour of Havana, where she lay to protect American citizens. The Court of Inquiry held that she had been blown up by an exterior mine. Whether by design or accident it was not their business to determine, but public opinion in the States entertained no doubts, and McKinley's u'timatum (April 20) demanding Spain's withdrawal from Cuba was tantamount to a declaration of war.

Spain was in a pitiable plight. She could not retreat, yet she knew that the issue would be settled at sea and that her Navy was hopelessly inefficient. Not that that of the United States was in an ideal condition, but it was more than equal to the task required of it. The whole campaign was over in Cuba by July 17, in Porto Rico by August 12, and in the Philippines—where, however, the insurgent Filipinos, under Aguinaldo, kept up a guerilla warfare on their own account until 1901—by August 14. The United States retained Porto Rico and Guam under the rules of war, and paid to Spain the sum of twenty million dollars in consideration of the transference of the Philippines. The United States, further, took Cuba under her tutelage for a while, but, when the people evinced a desire for modified independence, the Republic of Cuba was organised in 1902.

Theodore Roosevelt

In 1899, the joint protectorate of Great Britain, the United States, and Germany over the Samoan group having ended, the island of Tutuila, whose people had long wished for it, was annexed (along with other islands east of 171° W.) to the United States.

At home, McKinley's record did not stand so high. The tampering with the tariff had gravely affected foreign trade, but the passing of the Currency Act in 1900 secured the gold standard, and confidence was re-established. His re-election was a foregone conclusion (1901), but he was shot by an anarchist soon after his inauguration—the third Head of the States to fall to an assassin—and the Vice-President Theodore Roosevelt, of New York, ruled in his stead.

Owing to the conspicuous energy he had displayed as Governor of New York State, and as Colonel of the Rough Riders in Cuba, Roosevelt's accession was viewed with lively interest. He resolved, for one thing, that the Labour movement must no longer be ignored, and founded the Department of Commerce and Labour in 1903. It was clear, too, that he meant to make his country's influence a force in foreign affairs, for he was instrumental in promoting the conference between Russia and Japan at Portsmouth, New Hampshire, which brought the war to a close in 1905.

Panama Canal Completed

But the most valuable feature of his administration (he was re-elected for 1905–9) was his courageous support of the Isthmian Canal. Panama, originally a department of Colombia, declared its independence on November 4, 1903, and was promptly recognised by the United States, and soon afterwards by other Powers, with the exception of its mother State. As if delays were dangerous, a treaty was signed (November 18) between the United States and Panama affording facilities to the former for the construction and upkeep of the Canal. A zone of five miles on each side throughout the whole route was granted to the Company. Former failures thus redeemed, the undertaking was finished in 1914.

In following so picturesque and robustious a personage as Roosevelt, William H. Taft, of Ohio, the twenty-seventh President (1909–13), was somewhat handicapped. But he had been a distinguished lawyer and fearless judge, and his success as President of the Philippine Commission (1900–4) proved that, in administration, at any rate, he was the equal of his predecessor, whose policy in the main he adopted, especially in the matter of the Trusts.

President Taft was succeeded in 1913 by Woodrow Wilson, of New Jersey. Wilson, whose election testified to the extraordinary growth of Progressive and Radical principles in the electorate and who was everywhere regarded purely as an idealist, found himself confronted with realities as stern as any which ever confronted an American statesman—first with the problems arising out of the situation in Mexico, and then the infinitely more serious problems arising out of the World War. America's contribution to the victory of the Allies and Associated Powers was in many respects a notable one. On the continent of Europe, no less than on the high and the narrow seas, her armed intervention, although comparatively late in maturing, speeded up the accomplishment of the German surrender in 1918, and the solution of the intricate problem of the submarine menace. It yet remains for History to pass judgment on the way in which Woodrow Wilson handled these problems.

J. A. M.

Continued from page 278.

SCIENCES:

Contributors:—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc., D.I.C., F.G.S.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).

GEOLOGY.—IX (*Continued*)

Volcanic Eruptions. — A volcano may be defined as a rift or opening in the earth's crust from which hot gases and vapours, ashes and molten rock, in widely varying proportions, are vomited, often with explosive violence, and with intermittent periods of dormancy or rest. The ejected materials generally build up a cone-shaped mountain, which is truncated by a bowl-like crater.

Volcanoes of this kind, and the eruptions from them, are distinguished as the "central" type. Vesuvius, Stromboli, and Ætna are classical examples.

It would be misleading, however, to suppose that a conical mountain mass of lava and ashes is the most distinctive emblem of volcanic action. From time to time in the earth's history, great outpourings of lava have issued from long rents and fissures, and have spread over the surrounding country, far exceeding in their prodigious volumes the comparatively limited flows of central volcanoes. Yet in these cases few or no traces of cone formation have been detected, and, equally noteworthy, practically no ashes are associated with the widespread sheets of lava.

Volcanoes and eruptions of this kind are distinguished as the "fissure" type.

Classification.—On the basis of these two widely contrasted phases of vulcanism we may devise a working classification of volcanic eruptions. In *fissure* eruptions the lava is so fluid that it flows in nearly horizontal sheets. Owing to the fluidity the accompanying gases are able to escape easily, and the eruptions are therefore so free from explosive action that the lava is rarely blown to dust or ashes.

On the other hand, in *central* eruptions the lava is more viscous, and the gases, unable to escape, are pent up until their accumulated energy and pressure may lead to violent explosions with formation of ashes.

In the extreme case no lava may reach the surface, the whole eruption being confined to a terrific explosion in which the volcano blows away its own head, or in which a circular channel is drilled to the surface. The classification is therefore a continuous one, depending on the fluidity of the lavas and the explosive energy of the gases associated with them.

Eruptions from Linear Vents.—These may be classified as follows:—

1. Fissure Eruptions: Immense volumes of very fluid lava (predominantly basalt); gases escape

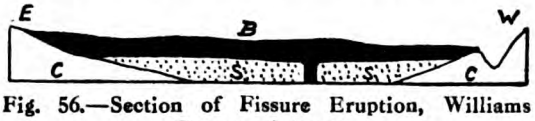


Fig. 56.—Section of Fissure Eruption, Williams Canyon, Arizona.

B = Basalt Flow, 800 feet thick; C = Crystalline rocks; S = Sand and gravel.

easily; explosions and ashes rare, e.g. Antrim (Giant's Causeway), Tertiary; Deccan, India, Tertiary. Late Cretaceous, Snake River, U.S.A. No active examples at the present day.

2. Icelandic Fissure Eruptions: Similar to the above, but with some explosive action, local ejection of ashes and small cones built up along lines of fissure, e.g. Laki, Iceland, 1782.

Eruptions from Central Vents accompanied by Lava Flows may be classified as follows:—

3. Hawaiian Type: Successive flows of fluid lava (mainly basalt), generally unaccompanied by fragmental material, e.g. Kilauea, Hawaii, Matavanu, Savaii, Friendly Islands.

4. Strombolian Type: Successive flows of lava, less fluid than in 3, accompanied (generally preceded) by explosions in which coarse and fine fragmental materials are ejected, e.g. Stromboli and the volcanoes of the Andes.

5. Vulcanian Type: Successive flows of lava, more viscous than in 4, accompanied by more

violent explosions with more abundant fragmental materials and including fine-grained ashes, e.g. Vulcano, Lipari Islands, Vesuvius, Ætna, Heckla.

6. Peléan Type: Lava so viscous that it fails to flow down the sides of the cone, but is thrust upwards and solidifies around or within the vent. Preceded by paroxysmal explosions accompanied by incandescent clouds of ashes and coarser fragmental material, e.g. Pelée, La Soufrière.

7. Mamelon and Puy Types: Similar to 6, but not accompanied by noteworthy explosions or ash

Fig. 57.—Section through Mt. Krakatoa showing the outline before and after the eruption of 1883 and how Mt. Rakata on the S. side of the cone came to be formed.

ejecta, e.g. Réunion, Indian Ocean, and Auvergne, France.

Eruptions from Central Vents Unaccompanied by Lava Flows may be classified as follows:—

8. Fragmental Eruptions: in which a cone is built entirely of ashes and other fragmental ejecta, e.g. Monte Nuovo, Fuji San, Japan.

9. Explosion Pipes: in which explosive gases drill a more or less cylindrical channel to the surface, e.g. diamond pipes of South Africa, volcanic pipes of Fife and Swabia.

10. Krakatoan Type: in which a paroxysmal explosion blows away a considerable proportion of a pre-existing volcanic cone, e.g. Krakatoa (1883), Bandi San, Japan.

To these it is convenient to add the following *dormant* or *decadent* phases of vulcanism, some of which resemble phenomena, having nothing to do with vulcanism:—

Eruptions Unaccompanied by Lava or Fragmental Ejecta are classified as follows:—

11. Solfataras: emit acid gases.

12. Fumaroles: emit steam with nitrogen and carbon-dioxide.

13. Mofettes: emit carbon-dioxide.

14. Geysers: emit boiling water explosively.

15. Mud Volcanoes: emit boiling water accompanied by mud.

16. Hot or Thermal Springs: emit hot water.

Volcanic Gases and Vapours.—According to their physical state the substances ejected from volcanoes may be classified as (*a*) gases and vapours, (*b*) liquids, (*c*) solids.

Gases and Vapours.—It has been proved by numerous analyses of volcanic gases that they appear in a certain order according to the temperature. The temperature in turn depends on the distance from the principal active vent of the volcano, and on the time which has elapsed since the last eruption.

From an active crater the gases are at so high a temperature that they are dry. That is to say, water, if present, is emitted in the form of superheated steam. The chief substances in addition to the latter are hydrogen, carbon-monoxide, methane, and the vapours of chlorides of fluorides, and of sulphur.

As the temperature drops and oxygen from the atmosphere has access to the gases, hydrogen burns and forms water vapour, carbon-monoxide forms carbon-dioxide, sulphur forms sulphur-dioxide. Steam acting on chlorides liberates hydrochloric acid. In this way *Solfataras* or acid fumaroles are developed.

The acid gases formed in the foregoing stage act on the rocks through which they force their way. From sulphides sulphuretted hydrogen is liberated, and from carbonates (e.g. limestone) carbon-dioxide is set free. Thus at this stage steam, nitrogen, carbon-dioxide and sulphuretted hydrogen are given off from *fumaroles*. Steam and carbon-dioxide continue to be emitted when other gases have ceased to be important. This is the *Mofette* stage.

Finally, only steam or water remains as the last representative of volcanic activity, and *geysers* and *thermal springs* are formed. The former are well known from their spectacular occurrence in Iceland, Yellowstone Park, U.S.A., and North Island, New Zealand.

Liquid Products of Volcanoes.—In so far as the water of volcanic districts is of volcanic origin it falls under this heading, though for convenience it has already been mentioned as the last member of the vapours.

The chief liquid material from volcanoes is, of course, *lava* or molten rock. It may be viscous or mobile according to its composition, its temperature, and the proportion of gas which enters into its composition.

The rate of cooling, the viscosity, and the expansion of escaping gases determine the structure of the resulting rock. When lava cools quickly a glassy rock is formed, e.g. *obsidian*. If gases are escaping abundantly the upper layers are torn into holes, and a spongy or *vesicular* rock results. Often the holes, or *vesicles*, are afterwards filled with minerals like chalcedony, calcite, and zeolites, and they are then called *amygdales*.

Pumice is an excessively vesicular rock of acid composition and light colour. Basic rocks like basalt, or other dark rocks which possess this cindery structure, are said to be scoriaceous.

When lava is flowing during its consolidation, the crystals formed within it, and the vesicles, are drawn out in the direction of movement, and the rock develops a *corded* appearance. Lava flows are given distinctive names according to their external structure.

Block lava (*Aa* of Hawaii, *Malpais* of Mexico), with a rough and ragged surface, and *Ropy lava* (*Pahoehoe* of Hawaii), often with a smooth or silky surface, and a corded, ropy form superimposed on broad domes and swellings, are the two chief. The latter sometimes flows in a series of bulbous protrusions so that on solidification the lava field looks like a vast collection of sacks or pillows. This structure is frequently developed when the lava flows into the sea or other body of water, and the rock is described as *Pillow lava*.

Volcanic Cones and Domes.—The rock

IN THE CRATER OF VESUVIUS.

A remarkable photograph taken in the interior. The smoke which can be seen issuing is laden with hydro-sulphurous gas.

bodies built up by volcanic action have been classified by Daly as follows:—

Lava Flows: (*a*) Block lava, ropy lava, pillow lava. (*b*) Lava scarps, lava cascades, lava tunnels. (*c*) *Tumuli*, low dome-shaped swellings. (*d*) *Hornitos*, gas-emitting vents which have built up driblet cones on the back of a lava flow.

Cones: (*a*) Tuff cones, cinder or scoria cones, ash cones. (*b*) Lava cones: (1) Lava domes (exogenous); (2) lava rings; (3) driblet cones. (*c*) *Composite cones* and breached cones. (*d*) Cone clusters, cone chains.

Plugs and Domes (endogenous) mamelons, certain puys.

Necks: (*a*) Tuff necks; (*b*) lava necks; (*c*) composite necks.

Tuff cones, known also by the alternative names given above, are made, as their name indicates, entirely, or almost so, of fragmental (pyroclastic) materials. They are generally small, and if built on the surface of a lava flow, or on the flanks of a volcano, they are known as *parasitical* cones.

Lava cones, composed wholly or mainly of lava, are comparatively rare. Their forms depend on the fluidity of the lava which enters into their composition. Very fluid lavas in many individual flows build up dome-shaped structures with gently sloping sides. The great dome of Mauna Loa (Hawaii) is the most famous example.

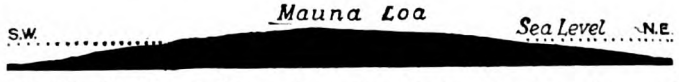


Fig. 58.—Profile of Mauna Loa, one of the great lava domes of Hawaii.

Scale: horizontal, 1 inch = 30 miles; vertical, 1 inch = 15 miles.

Composite cones represent by far the commonest type. From the classification of volcanic eruptions given on pages 335, 336, together with the fact that volcanoes generally pass through several of the stages during their life history, it follows that most cones are of very complex structure. The simplest type is the *breached* cone, a tuff cone from which one or more lava flows have escaped, breaking down the sides. Many of the cones of Auvergne are of this simple form. The great volcanoes of the Mediterranean, of Java and the Andes, are much more complex, being due to a succession of eruptions of lava and ashes.

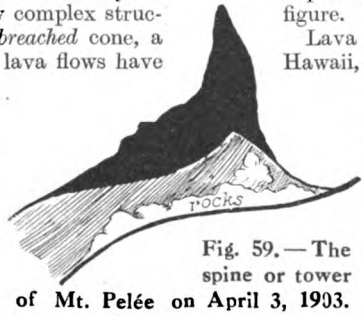


Fig. 59.—The spine or tower of Mt. Pelée on April 3, 1903.

Volcanic plugs are represented by the famous *spine*, *tower*, or *needle* (as it has been variously called) of Mt. Pelée, which was upthrust in 1902 at the close of a paroxysmal and devastating eruption. The lava was too viscous to flow, and was sluggishly thrust upwards for several months, till the attack of the weather reduced its extravagant form to more stable proportions.

Volcanic necks are of three kinds, according to their composition (tuff, lava, or composite). They may be the underlying feeders of volcanoes, the superstructures of which have been entirely destroyed by erosion. It is in fact largely due to denudation that we owe our knowledge of the internal structures of volcanoes. Denudation is constantly dissecting volcanoes, and by comparing examples of different antiquity every stage can be made out.

Fig. 60.—The nested craters of Mt. Ætna, 1810–16.

Craters and Calderas.—Daly's classification of the negative (depressed) topographic forms associated with volcanic eruptions is as follows:—

Craters: Lava pits; maars (volcanic embryos); blowholes; adventive, parasitic, or lateral craters; nested craters.

Calderas (evisceration by explosion): Simple calderas with or without lava discharge; Nested calderas; Sunken calderas.

Volcanic Sinks (engulfments or down-faulting): Simple and nested sinks.

A *crater* is a cup or inverted cone-shaped depression at the summit of a central vent, giving communication to the gases, lavas, and ejecta from the pipe or fissure below to the atmosphere above. The floor of a crater is generally a flat surface of solid or liquid lava, or it may be buried under a load of debris from the sloping walls.

Craters are formed by gaseous explosions, by slumping (land-slipping), or by melting of the walls of the vent. Their diameters are greater than those of the vents below, according to the angle of slope of the walls and the depth. Vents are seldom over 1,000 ft. in diameter, and the depth of a crater rarely exceeds the same figure.

Lava pits are craters, like those of Hawaii, visibly floored with lava.

Maars are craters (flat-floored) at vents which are not provided with cones (volcanic necks of Swabia).

Blowholes are the minute craters of driblet cones.

Nested craters are sometimes seen, in which one or more small craters are enclosed within a larger and older crater (Vesuvius in 1799, Ætna 1810–16).

Calderas are over-widened or over-deepened craters, formed, according to the definition adopted, by paroxysmal explosion, or by down-faulting of the summit of a volcano. The former is the original significance of the term, and the latter case is now distinguished under the name of *volcanic sink*. Each of these forms differs from a true crater in that the floor area is many times greater than that of the vents issuing into them. The calderas of Bandai San (Japan), formed in

1888, of Rotomahana (New Zealand), and the sunken calderas, largely occupied by the sea, of Santorin and Krakatoa (*see* Fig. 57) are famous examples.

Volcanic sinks are represented in Kilauea and Mauna Loa, and other examples are those of Réunion (Indian Ocean), Tengger (Java), and Crater Lake, Oregon (U.S.A.).

Distribution of Volcanoes. — Volcanoes are sometimes arranged in *chains*, like the gigantic cones of Java. Other famous chains are those

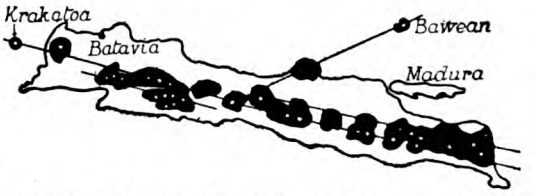


Fig. 61.—The volcanic chain in Java, showing relation to fracture lines. White dots represent the principal vents.

of the Hawaiian Islands, of North Island, New Zealand, of the Lipari Islands, of Japan, of the Andes, and of East Africa. We have here a clear indication of the alignment of volcanoes along fissures and zones of fracture in the earth's crust.

Volcanoes may also be arranged in *clusters*, like the extinct puys and cones of Auvergne (in which a main chain may also be recognised). The volcanic necks of Fifeshire, of Swabia, and of South Africa, and the cones of the Azores and the Canary and Cape Verde Islands, have a similar arrangement. In some cases this mode of grouping suggests that the volcanoes are fed from underlying laccoliths which have penetrated fissures and spread laterally before reaching the surface.

The distribution of volcanoes is shown on the map in Vol. I., p. 366. A. H.

ZOOLOGY.—XXXIV

THE *Beetles*, included in the order *Coleoptera*, constitute a great division of insects, computed at anything from 100,000 to 150,000 species, in which the fore wings are used as sheaths to the membranous hind wings. These fore wings are useless for flight, but they are well suited to the purpose they are made to serve, since they are of the same hard texture as the other parts of the body.

All beetles undergo complete metamorphosis, but the larvæ of different families differ considerably. Important differences occur also in the adult insects; and it is necessary that this should be so, since the habits of beetles cover all methods of life. Some beetles are terrestrial, some are arboreal, and some again are aquatic; some frequent the mountains, others live on the plains; some live in the open, others frequent human habitations. Their manner of life, in short, exhibits an infinite variety that is reflected in their form. The mouth, which is generally well developed, is subject to considerable modification according to the food and habits of the species concerned, and this fact is used to some extent as the foundation for a system of classification. As is the case with some other insects, however, the complete and authoritative classification of beetles is a benefit which fuller and more complete knowledge alone can bring.

Returning for a moment to the larvæ, we find that they are generally elongated, clothed with a stout skin and furnished with six feet, but the rule has many exceptions. None the less, though great variations occur in other respects, all the larvæ are alike in this, that they have heads clearly distinguishable from their bodies.

Beetle Habits

A habit, characteristic of the beetles, is a passion for concealment. Very rarely do we encounter a beetle of any species in any country but what its movements suggest that the meeting has been accidental, and from every point of view more or less regrettable. For every beetle that we see, it may safely be said that there are a hundred which have escaped our notice.

The vast majority only make a brief appearance at night, spending the greater part of their lives in hiding. If they are to be discovered it is necessary to search under stones, in decaying timber, in terrestrial and aquatic vegetation; in the soil, in the stems of plants, in moss, in manure heaps, in the innermost corners of unlikely recesses, and even in the nests of ants and wasps. Some few species there are which brave the day, and may be found in the spring and early summer climbing on foliage or running on paths. But let some sudden calamity threaten the safety of the hidden hosts, and we soon perceive how great is the disparity in numbers between the diurnal and nocturnal species. A sudden flood, even in temperate climes, will frequently suffice to cover every twig with a panic-stricken mob. Where a short while before not a beetle was to be seen, the repre-

*** ERRATA: Vol. V., p. 143: for "Gramophyre, showing outergrowth" read "Gramophyre, showing intergrowth"; for "Purite" read "Picrite."

sentatives of a hundred different species will jostle each other in a frantic rush to safer ground.

The Tiger Beetles, of the family *Cicindelidæ*, are elegantly formed and nimble insects represented in Great Britain by four species. Flight by these species is rapid but seldom long sustained; the insects are, however, very agile on foot. The eyes are prominent and the mouth adapted to seize prey. Most of the thousand or so species into which the *Cicindelidæ* are divided frequent sunny spots where the soil is light, such as the banks of rivers or the pathways of heaths and woods. The larva burrows a deep cylindrical gallery in which it conceals itself, and where it entraps such careless insects as fall in. The commonest of the British species is the *Cicindela campestris*, which is of grass-green colour with the undersides and legs of coppery and golden lustre. Four cream-coloured spots occur on each wing-case. The *C. sylvatica* is found on the heaths of certain southern localities, and the *C. maritima* is so called from its partiality to the sandy seashore. The *C. germanica* is very rare in England.

Carnivorous Ground Beetles

The family *Carabidæ*, or Carnivorous Ground Beetles, comprise a group of varied habits and somewhat diverse forms. In most cases the larva has an elongated body carried by six legs, with an oval head and a mouth adapted to food of a semi-fluid description. Both the larva and the perfect insect haunt dark and well-sheltered spots. They may be found beneath logs of wood, in moss, amongst dead leaves and in similar places. Something like ten thousand different species are said to be comprised in this family, and between them they effectively cover all countries and climatic conditions. In temperate latitudes they are

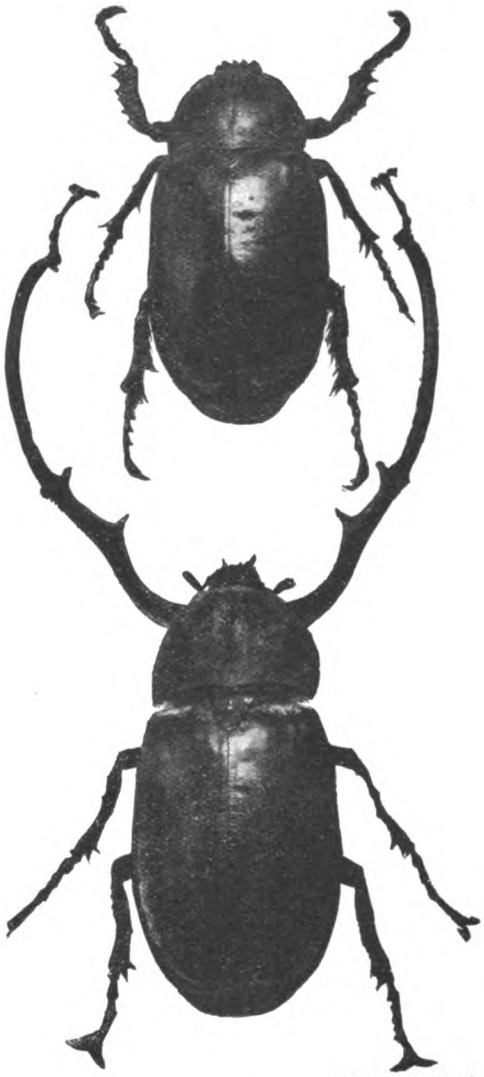


Photo: H. Bastin,

Giant tropical beetles. Note the large fore legs in the lower specimen, which are very useful when an admired female proves too coy.

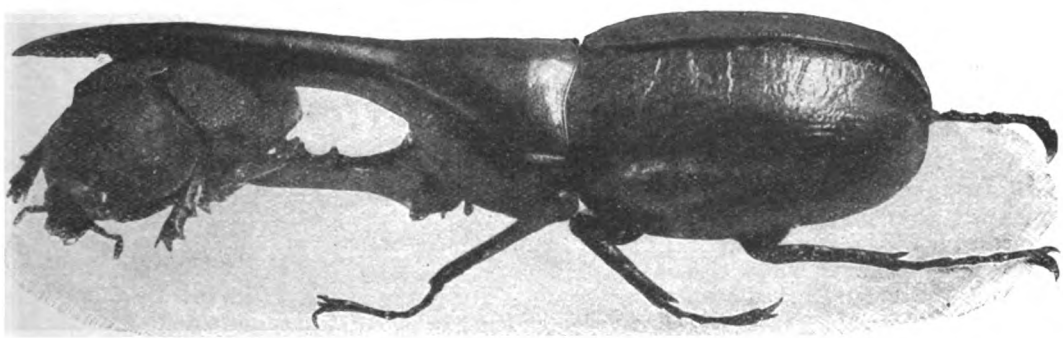


Photo: H. Bastin.

The Hercules Beetle, an American monster, wastes no time in persuasive argument; he picks up and carries off his lady love.

generally ground insects, but in tropical climes they are more frequent upon trees.

In Britain the *Carabidæ* are rarely seen abroad during the hot and dry summer weather, and their favourite winter retreat is a bed of moss screened from the damp. They are fleet of foot, able fliers, and experts in the art of concealment. Some species, not content with these advantages, have added the peculiar ability to discharge an acrid liquid at their pursuers. In one well-known group, the *Brachini*, the liquid is volatilised and issues as a puff of smoke. The *Brachinus crepitans*, common in the south of England, has from this habit earned the title Bombardier Beetle. It has a reddish-brown body, and elytra dull black tinged with blue. But the discharge of the bold Bombardier would be ridiculed by some South American species, such as the *Pherosophus complanatus*, which fire with far greater force, noise, and frequency.

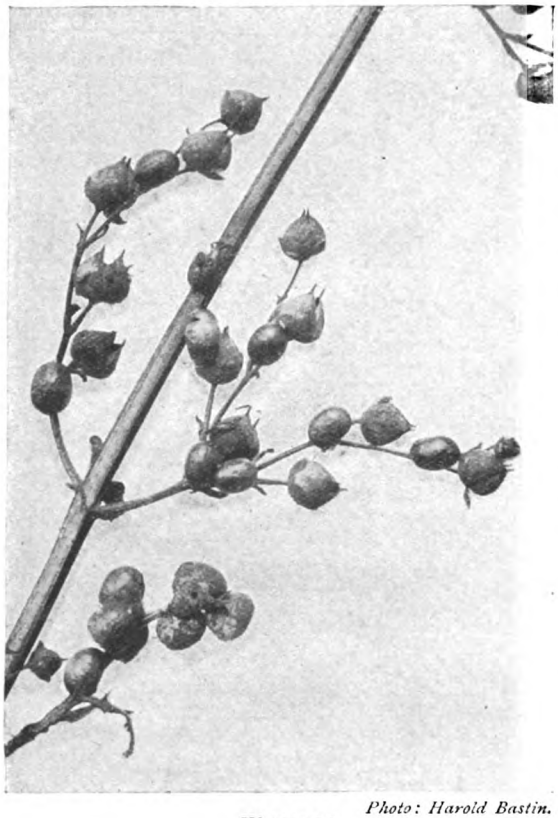


Photo: Harold Bastin.

WEEVILS

are very destructive of plant life. When fully grown they go to flower-heads, where they spin cocoons (several can be seen in the above photograph) which closely resemble seed capsules—a striking instance of protective mimicry.

Another well-known British species of this family is the *Broscus cephalotes*, found under debris upon the seashore.

In the family *Dyticidæ* the legs and body are adapted to the requirements of an aquatic life, otherwise these insects largely resemble the *Carabidæ*. A most interesting point of difference between these groups is found in the antennæ, which are much smoother in the aquatic species than in the land beetle. It is supposed that the modification has resulted from the fact that a hairy surface beneath the water would tend to collect minute bubbles of air, and thus would prove a less reliable medium for the transmission of impressions. The *Dyticidæ*, which hibernate throughout the winter in soft mud, haunt stagnant waters in the spring. They propel themselves when swimming by the powerful hind legs, and breathe when under water by carrying a small supply of air beneath the wing-cases. This supply is replenished from time to time by visits to the surface.

Whirligig Beetles

The Whirligig Beetles, of the family *Gyrinidæ*, gain their name from the intricate evolutions which they carry out above the surface of the water. In many respects they resemble the *Dyticidæ*, but whilst in the *Dyticidæ* the hind legs are the largest, in this group it is the anterior legs to which most importance attaches, the hind legs being short and broad. The female of the *Gyrinidæ* lays her eggs in the leaves of aquatic plants, and the larva when it appears bears some resemblance to a small centipede. The common British Whirligig Beetle is typical of many other species.

The family *Hydrophilidæ*, like the *Dyticidæ*, have the hind legs adapted for swimming. For the most part they are large water-frequenting insects, but they are not carnivorous. As swimmers they are scarcely so swift as some species, and doubtless this fact would tell against them had they to depend upon what they could catch. However, the mouth is adapted to a vegetable diet. The Great Black Water Beetle is the largest of the British species.

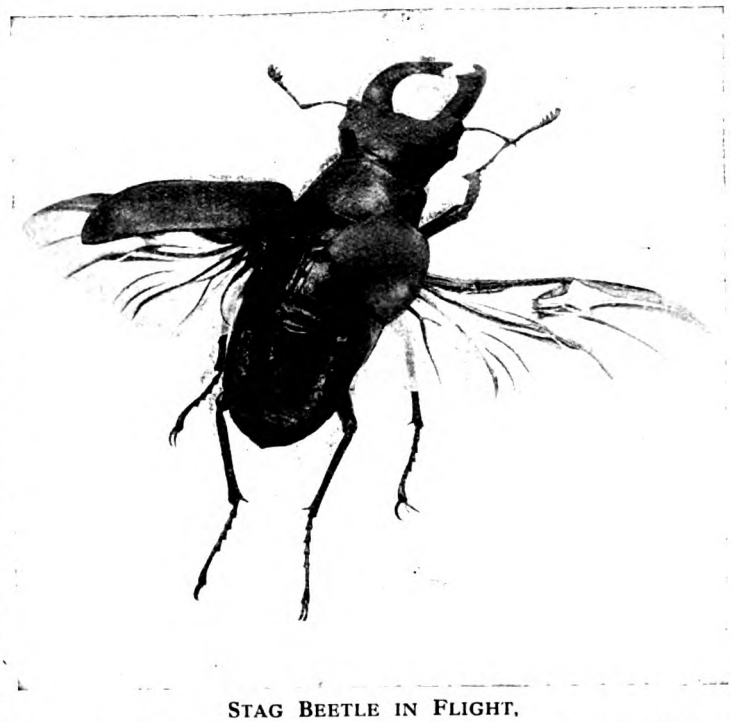
The family *Staphylinidæ* has a well-known British representative in the Devil's Coach-horse. This strangely-named insect, like most of the members of its family, has very abbreviated elytra, as the hard forewings are termed. They are, in fact, so short

that they do not serve even to afford protection for the membranous wings, which are of normal length. The Devil's Coach-horse, when placing the membranous wings beneath the elytra, pushes them with the tip of its body, which it twists upwards for the purpose. This upward twist is, however, in some small species a permanent habit.

The *Pselaphus Heisii*, of the family *Pselaphidæ*, is another beetle with abbreviated wing-cases. It is found at the roots of herbage on sandy banks, especially near to water.

The Burying Beetles, of the family *Silphidæ*, are well known to most people from their habit of burying the carcasses of birds, small mammals and reptiles, a work which is of the greatest service to mankind, although performed from purely selfish motives. As a matter of fact the Burying Beetle is concerned only for its larvæ. Its eggs are deposited in the carcass, and when they hatch it is upon the carcass that the larvæ feed. The methods of this useful insect can be readily followed by anyone who cares to place a dead mouse or some similar animal upon light soil in a field suitable to insects generally.

If visited a day or two later, in all probability several species of the Burying Beetles will be seen hard at work. These beetles, by excavating the soil beneath, gradually lower the carcass, in some cases to the depth of a foot. They are more gaily coloured than is customary with individuals of their profession in the highest grade of life. The *Necrophorus Vespillo*, in fact, which is reputed to be the handsomest of his genus, carries broad bands of bright orange



STAG BEETLE IN FLIGHT.

There is a large group of these wood-feeding insects, belonging for the most part to tropical climes.

Photos: Harold Bastin.

THE GOLIATH BEETLE.

A West African monster. It is approximately the size of a man's fist, and feeds upon the sap of trees.

and yellow, by means of which he may be readily distinguished in our streets and gardens in spring time.

The largest and handsomest beetles are found amongst the *Lamellicornia*, and are known as Scarabæi, Cockchafers, Maybugs, etc. All the larvæ of this tribe show a considerable resemblance to each other. The head is rounded and horny, the bodily form cylindrical and curved inwardly towards the hind extremity, the skin is fine and semi-transparent.

Cockchafers and Stag Beetles

Perhaps the most famous of the perfect insects are those of the sub-family *Cetoniinæ*, in which the horns which frequently ornament the head and thorax show some resemblance to those of large mammals such as the rhinoceros and the stag. All these beetles, the Cockchafers especially, are strong fliers. In the great Rhinoceros and Elephant Beetles of the tropics the wing muscles are abnormally developed to enable these insects to carry their heavy bodies for long distances through the air.

The Stag Beetles are a large group of wood-feeding insects of the family *Lucanidæ*. The majority of these beetles belong to tropical species. Of the three British representatives the *Lucanus cervus* has the distinction of being the largest of the British Coleoptera. In the male insect the jaws are horn-like and capable of giving a painful bite, but in the female, though sharp, they are curved and less conspicuous.

The common Cockchafer, of the family *Scarabæidæ*, when present in numbers, as fortunately it rarely is in Britain, can prove an exceedingly destructive insect, as was shown in France in the year 1866 when the damage done by cockchafers in the Department of the Seine-Inférieure alone was estimated to exceed one million sterling. The perfect insects had stripped the trees of their foliage, and the larvæ had devoured the roots of all kinds of crops and grass. The larva grows for two years before reaching the pupa stage, in which state it remains a further eight months before attaining its adult form. The cockchafer is active at night, but lies concealed throughout the day.

The Hercules Beetle is a monster species of tropical America, sometimes exceeding five inches in length. The long mandibles possessed by the male are said to prove very useful when an admired female proves too coy. In such circumstances the Hercules Beetle, wasting no time in persuasive argument, picks her up and carries her off.

The Goliath Beetle is another monster tropical species found in West Africa. It approximates to the size of a man's fist and is found by the natives feeding upon the sap of trees.

The Glow-worms, of which there are several species, are included in the family *Lampyridæ*. The light diffused by these small insects owes its origin to phosphorescent particles concentrated in the abdomen. The male of the common Glow-worm has a longish body with wide wings, and is brown in colour; the female, on the other hand, is altogether without wings, and has a stronger resemblance to an insect in the larval stage than to a full-grown beetle.

The Fireflies, of the genus *Pyrophorus*, may be found in North and South America to the number of about ninety species. Their light is far stronger than that of the glow-worm, and far more baffling. It flashes, glows and disappears in a manner more than perplexing to the belated traveller unaccustomed to its vagaries.

The Destructive Weevil

The great family of Weevils, *Curculionidæ*, may be known by their elongated snouts at the extremity of which are placed their small but powerful jaws. They are amongst the commonest of all beetles both in temperate and tropical climates, and number, it is computed, some 30,000 different species. They are most destructive to all forms of plant and vegetable life, especially in the larval stage, and even attack seeds and cereals stored in warehouses.

One of the least popular of the Weevils is the *Calandra granaria*, which is responsible for the damage to grain. The female nibbles minute holes in grains of corn, in which she places her eggs. When the grub is hatched it lives upon the interior of the grain and thus destroys its value without affecting its appearance. The grub undergoes metamorphosis within the grain, and some forty or more days after the egg was laid makes its exit as a winged beetle.

This brief sketch of some of the better-known beetles may well close with a reference to what is probably the only beetle which is not popularly viewed with distaste. Familiarly known as "Lady Birds," the members of the family *Coccinellidæ*, when encountered are greeted as harbingers of good luck. About forty different species have been described as resident in Britain; all are extremely useful as destroyers of plant-lice. The commonest are the Seven-spotted and the Two-spotted. A. B.

ANATOMY AND PHYSIOLOGY. XVIII

THROUGHOUT these lessons it has been insisted that the most important thing in physiology is the power of adaptation to surroundings. That power is a special gift of all living things, and when living things lose it they die.

The body is a machine which is kept going by its power of adaptation: when dangers are about it avoids or overcomes them; when it requires food it takes it from its surroundings. The surroundings are perceived by means of the sensory nerves, either by those of the skin, for things which are actually in contact with the body, or those of the eyes and ears for things at a distance from the body. The sensations conveyed by these nerves are received and interpreted by the brain, and the necessary movements are made by the muscles.

Let us see how this idea evolves in the performance of the work which is the daily occupation of all of us.

Controlling Functions of the Brain

Compare the work done by a skilled workman with a chisel with the work of a beginner. The beginner sees his wood, his chisel and his hammer: his brain sends out impulses to his arms and hands accordingly. But in nearly all cases he will cut too far, his blows will be too strong, he will cut away more wood than he need. The skilled workman uses the same muscles, but he wastes no strength, his chisel only goes the required distance. Why is this? His movements are controlled, they are checked as soon as they have gone far enough.

One of the most important functions of the higher parts of the brain is this control; it is thus that the movements made in all skilled work are adapted exactly to the required force and direction.

In using a hammer, the chief movement of the elbow is extension or straightening, but when the force of the blow has to be carefully regulated the flexor or bending muscles are contracting slightly at the same time, and act as a brake. A skilled workman's stroke is such, that the bending muscles *brake down* the straightening muscles, till a blow of the exact force required can be given.

This power of harmonious working of two opposite groups of muscles is called "co-ordination" or "arrangement together," and all exact movements depend upon it.

We have seen how the sensory nerves are distributed to the skin. Sensory nerves are also distributed to the muscles and joints, as well as motor nerves, and impulses reach the brain of the skilled workman from his contracting muscles, which tell him when the muscles have contracted enough, and when it is time to put the brake on by means of the opposite muscles.

But, you may say, surely the same sensations are going to the brain of the unskilled workman; why does he not check his hand in time? True, the same sensations do occur in the unskilled man, but he has no *memory* of many such sensations, and so does not know how to respond to them.

Locomotion and Prehension

In the human body, which is very highly specialised, the upper and lower limbs are set apart for different purposes to a considerable extent. The lower limbs, the legs, are chiefly used for "locomotion," that is, walking and running, and the upper limbs for "prehension," that is, grasping, and all the numerous uses which arise from the power to grasp.

Walking is a highly co-ordinated series of movements, in which many muscles are employed, in response to impulses coming from many different nerves.

When a man stands, his body is said to be in "unstable equilibrium," he is only just balanced on his feet. A dead body cannot be set up on its feet, a baby cannot stand, a man in good health cannot stand up when he is asleep. When you stand, your body is continually inclined to fall over, and it is only through the contraction of different groups of muscles that you are able to stand erect at all.

Sensations reach your brain from the soles of your feet, and also from your joints—those of ankles, knees, hips, and spine—and as soon as there is the least inclination of your body to fall over to the right, the muscles on the left contract and pull you up straight again.

In walking, the weight is taken by each leg alternately, and the arrangement is such that there is the least possible expenditure of muscular force.

When the weight is put on one leg, say the right, the body inclines to fall to the left because the "centre of gravity," or the bulk of the weight of the body, is to the left of the point of support. To counteract this the muscle between the outside of the ilium and the top of the thigh bone, the *gluteus medius*, contracts and helps to hold the body

up straight. Place your hand just above your hip joint when you walk, and you will find that as the weight of the body is taken by the right leg, the muscles at this point contract. At the same time the knee and ankle are held firm by the muscles which act on them.

Meantime the left leg swings forward like a pendulum, very little muscular effort being required; but there is slight drawing forward (protraction) of the hip by the psoas and iliacus, and straightening of the knee by the quadriceps extensor. At the same time the muscles on the front of the shin contract and bend the ankle and lift the toes clear of the ground.

The left leg swings forward, the body moves forward after it, the heel strikes the ground, and becomes fixed to it for the moment, the body weight being now borne by the left leg, and the right swings out in its turn.

Walking has often to be carried out for many hours at a time, and it is important that it should involve the least possible fatigue; hence the advantage of the arrangement whereby the leg is made to swing partly as a pendulum without effort, and the limiting of the muscular work done by the extensors to a minimum. This depends on impulses coming through the sensory nerves.

Motor and Sensory Co-ordination

There is a disease in which the sensory tracts in the cord are damaged; people who suffer from this are "inco-ordinate" in their walking. They know that they have to lift their feet to clear the ground, so they lift them high in order to be sure of getting them high enough; there is thus a waste of muscular effort because their brains do not receive the information to tell them exactly when the movement has proceeded far enough.

There are two sides to co-ordination: motor and sensory. The importance of sensory impulses is well illustrated in the lower limbs, where loss of those impulses leads to inco-ordinate walking. The motor side of co-ordination is perhaps better understood in studying the use of the hands. We have seen how skilled movements and skilled use of tools depend on sensations which tell the workman when his hand has gone far enough, but there must also be a motor mechanism which directs the harmonious action of the opposing groups of muscles which ensues in response to these sensations.

This is thought to be largely due to the cerebellum, that mass of brain substance which lies above the fourth ventricle and below the occipital lobes of the cerebral hemispheres. In disease of the cerebellum there is imperfect co-ordination of the limbs, which takes the form of tremors; the limbs shake; there is alternate action of the opposing muscles of joints. This shows that these opposing muscles are not working harmoniously together, as they must if precise movements are to be made, but irregularly, first one and then the other, from which we conclude that the motor impulses which control co-ordinated movement are due, in part at any rate, to the cerebellum.

The Semicircular Canals

Another matter of great importance for co-ordinated movement is knowledge of the position of one's head in space, that is the faculty of telling, in the dark, whether you are head upwards, or head downwards, sitting, standing, lying, or whatever it may be.

This is also a function of the cerebellum, which it exercises by means of impulses which come to it by what are called the semicircular canals.

In describing the internal ear, we saw that this consisted of the cochlea, and was embedded in the temporal bone in the base of the skull. Behind the cochlea and communicating with it is a cavity called the vestibule, and with the vestibule communicate the three semicircular canals. There are hollow tubes which lead out of the vestibule and back again into it; they are arranged at right angles to one another. One is horizontal, two are vertical. One of the vertical tubes leads outwards and forwards (anterior vertical), and the other outwards and backwards (posterior vertical). At its front end each has a little swelling called the ampulla. They contain fluid and are supplied by the auditory nerve.

If the canals of the two sides are compared, it will be seen that each is in a plane, which is parallel to one on the opposite side. Thus the two horizontal ones are in the same plane. The anterior vertical on the right is in a plane parallel to the posterior vertical on the left, and vice versa. If you move your head to the right you increase the pressure of the fluid in the ampulla of your right horizontal canal, and decrease it in that of your left horizontal canal. The impulses which reach the brain from the semicircular canals indicate the direction in which your head is being moved.

D. W. C.-J.

Continued from page 292.

LANGUAGES:

Contributors **:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A. [Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).**

GERMAN.—XXXV

Composition of Nouns.—The majority of compound nouns are made up of a noun with a preceding limited word; the gender of the compound is almost always the same as that of the last member of the compound, and so is its declension.

These nouns may be arranged under the following headings:

(*a*) A noun preceded by a qualifying adjective, such as der Leichtſinn, *recklessness*, der Edelſtein, *precious stone*.

In the majority of these compounds the adjective appears in its uninflected form, but in a few the adjective is declined like an independent word. Thus, der Hoheprieſter, *the high priest*, die Langeweile, *boredom* (literally, long while).

(*b*) A noun preceded by a limiting noun which appears in its uninflected form. Thus, der Buchdrucker, *printer* (bookprinter), der Handſchuh, *glove* (hand shoe), der Briefträger, *postman* (letter carrier).

Very often the first noun is a genitive dependent on the second, and in many cases the first noun actually appears as a genitive. Thus, der Sonnenſchein, *sunshine*, das Wirtshaus, *inn* (host's house).

Occasionally the s of the genitive is attached to words which do not, as single words, take s. Thus, die Liebeserklärung, *declaration of love*, die Wahrheitsliebe, *love of truth*.

A certain number, again, appear with the first noun in the plural. Thus, das Wörterbuch, *dictionary* (book of words), das Frauenkloſter, *nunnery* (cloister of women).

(*c*) A noun preceded by the root of a verb which has the force of a qualifying adjective or noun, such as der Kochofen, *cooking stove*, die Gießkanne, *watering can*.

(*d*) Nouns preceded by a particle which has the force of a qualifying word, such as die Anſicht, *opinion* (view on), der Mitmenſch, *fellow-creature*.

(*e*) Nouns made up of an Infinitive and preceded by words dependent on it, such as das Zuſammenwachſen, *coalescence, growing together*, das Auseinandertreiben, *scattering*.

(*f*) Nouns which designate some object by one of its characteristics. These are of various kinds. They may consist of:

A noun preceded by a limiting word, such as das Rotkelchen, *robin redbreast* (little red neck), das Viereck, *square* (four corners).

An adjective preceded by a limiting word, such as das Immergrün, *evergreen*, der Gernegroß, *coxcomb* (a would-be great person).

A verb with a following object or a limiting word or words which either precede or follow it, such as der Taugenichts, *good-for-nothing*, das Stelldichein, *appointment, rendezvous* (make thy appearance), der Nichtsnutz, *ne'er-do-well*.

In addition to these there are, of course, what may be termed compound compounds. That is to say, nouns made up of words which are in themselves compounds, such as der Damenſchuhmacher, *ladies' bootmaker*, der Reichspoſtangeſtellte, *employee of the imperial post*.

We stated above that nearly all compound nouns follow their last member as regards gender and declension. The following are the most important exceptions:

(*a*) Names of towns are neuter even though the last member of the compound is masculine or feminine. Thus, das Hamburg, but die Burg, *castle;* das Wittenberg, but der Berg, *mountain*.

(*b*) Most compounds of Mut, which is masculine, are feminine. In its simple form it means courage or mood or spirit. In compounds we mostly find the two latter meanings. Thus, die Demut, *humility*, i.e. the humble spirit; die Großmut, *magnanimity*.

(*c*) Other miscellaneous exceptions are: der Mittwoch, *Wednesday* (mid-week), which, like all the days of the week, is masculine; but die Woche, *week*; das Gegenteil, *contrary* (the opposite part), but der Teil, *part;* der

Abſcheu, *aversion*, but die Scheu, *fear, shyness*; die Antwort, *answer*, but das Wort, *word*.

Composition of Adjectives.—These may be arranged under the following headings:

(*a*) Adjectives made up of two adjectives which either have the same value, such as graugrün, *grey green*, taubſtumm, *deaf mute*, or of which one limits the meaning of the other, such as dunkelrot, *dark red*, tollkühn, *venturesome* (mad brave).

(*b*) Adjectives made up of an adjective or participle preceded by one or more limiting adverbs, such as wohlriechend, *sweet-smelling*, ſogenannt, *so-called*, hochwohlgeboren, *highly well born*. (This is used as a polite form of address, especially in Austria).

(*c*) Adjectives made up of an adjective and a preceding limiting noun, such as grasgrün, *grass green*, eiskalt, *cold as ice*, pechſchwarz, *black as pitch*.

(*d*) Adjectives made up of a participle and a dependent noun, such as wutſchnaubend, *snorting* (with) *rage*, herzerquickend, *heart-refreshing*, gottverlaſſen, *God-forsaken*.

(*e*) Adjectives made up of an adjective, and a preceding noun in the genitive, such as hoffnungslos, *hopeless*, vertrauenswürdig, *worthy of confidence*.

VOCABULARY

Fiſch, s.m.2, *fish*.
denkwürdig, *memorable*.
brauſen, w., *to roar*.
baſaltiſch, *basalt*.
glühend, w., *to glow, be red hot*.
Spalte, w.f., *crack*.
Waſſerſpiegel, *surface of the water*, s.m.1.
Leiden, s.n.1, *suffering*.
mitleidlos, *pitiless*.
Zuſammenhang, s.m.2, *connection*.
feurig, *fiery*.
Schranke, w.f., *barrier*.
durchbre'chen, s., *break through*.
klingen, *sound*, s., *clink, tinkle*.
fröhlich, *joyous*.
Schöpfung, w.f., *creation*.
an'heben, s., *to begin*.
Burg, w.f., *citadel, stronghold*.
Degen, s.m.1, *warrior*.
Arbeit, w.f., *work*.
Normann, *Northman*.
widerſpänſtig, *unruly*.
Sattel, s.m.1, *saddle*.
erklärlich, *explicable*.
Leumund, s.m., *reputation*.
Herrſchaft, w.f., *rule*.
Waſſermöwe, w.f., *seagull*.
Tiefe, w.f., *deep*.
ziſchen, w., *to hiss*.
Maſſe, w.f., *mass, block*.
Rinde, w.f., *crust, rind*.
ſich einen Weg bahnen, w., *to cut one's way*.
Umwälzung, w.f., *upheaval*.
vernichten, w., *to destroy*.
trotzig, *defiant*.
Kern, s.m.2, *core*.
vorhanden, *existing*.
Geſtein, s.n.2, *stone, rock*.
Gedächtniß, s.n.2, *memory*.
Pracht, s.f.2, *splendour*.
jubeln, w., *to rejoice, exult, jubilate*.
Mauer, w.f., *wall*.
hauſen, w., *to live, reside*.
Kriegszug, s.m.2, *campaign*.
Welſchland, *Italy*.
Ungar, *Hungarian*.
übermüthig, *presumptuous*.
zeitlebens, *for the duration of life*.
Lehnſtuhl, s.m.2, *armchair*.
ſanft, *gentle*.
Sachſen, *Saxony*.
Chroni'k, w.f., *chronicle*.
Kriegsmann, s.m.3, *warrior*.
Ehgemahl, s.n.2., *spouse*.
Baiern, *Bavaria*.
natürlich, *natural*.
Gefallen, s.m.1, *favour, pleasure*.
pflegen, w., *to care for, nurse*.
Kummer, s.m.1, *grief*.
ſich ſchaffen, *to acquire*.
Zwingherr, w.h., *despot*.
Mönch, s.m.2, *monk*.
ertragen, s., *to bear, suffer*.
verſammeln, w., *to gather*.
erleſen, s., *to choose*.
Neige, w.f., *decline, wane*.
Grund, s.m.2, *reason, cause*.
hegen, w., *to cherish*.
zu'kommen, s., *to behove suit, befit*.

Exercise 77 (*continued from* 75)

Für Fiſche und Waſſermöwen mag's[1] ein denkwürdiger Tag geweſen ſein, da es in den Tiefen brauſte und ziſchte, und die baſaltiſchen Maſſen glühend durch der Erdrinde[2] Spalten ſich ihren Weg über die Waſſerſpiegel bahnten. Aber das iſt ſchon lange her. Es iſt Gras gewachſen über die Leiden derer, die bei jener Umwälzung mitleidlos vernichtet wurden; nur die Berge ſtehen noch immer,[3] ohne Zuſammenhang mit ihren Nachbarn, einſam und trotzig wie Alle, die mit feurigem Kern[4] im Herzen die Schranken des Vorhandenen durchbrechen, und ihr Geſtein klingt, als ſäße[5] noch ein Gedächtniß an die fröhliche Jugendzeit drin[6], da ſie zuerſt der Pracht der Schöpfung entgegen gejubelt.[7]

Zur Zeit, da unſere Geſchichte anhebt, trug der hohe Twiel ſchon Thurm und Mauern, eine feſte Burg.[8] Dort hatte Herr Burkhard gehauſt, der Herzog in Schwaben. Er war ein feſter Degen geweſen und hatte manchen Kriegszug gethan; die Feinde des Kaiſers waren auch die ſeinen, und dabei[9] gab es immer Arbeit: wenn's in Welſchland ruhig war, fingen oben die Normänner[10] an, und wenn die geworfen[11] waren, kam etwann[12] der Ungar geritten, oder es war einmal ein Biſchof übermüthig oder ein Grafe widerſpänſtig,[13] — ſo war[14] Herr Burkhard zeitlebens mehr im Sattel als im Lehnſtuhl geſeſſen. Demgemäß iſt erklärlich, daß er ſich keinen ſanften Leumund geſchaffen.

In Schwaben ſprachen ſie, er habe die Herrſchaft geführt, ſo zu ſagen als Zwingherr, und im fernen Sachſen ſchrieben die Mönche in ihre Chroniken, er ſei ein kaum[15] zu ertragender Kriegsmann geweſen.

Bevor Herr Burkhard zu ſeinen Vätern verſammelt ward, hatte er ſich noch ein Ehgemahl erleſen. Das war die junge Frau Hadwig, Tochter des Herzogs in Baiern. Aber in das Abendroth eines Lebens, das zur Neige[16] geht, mag der Morgenſtern nicht freudig ſcheinen. Das hat ſeinen natürlichen Grund. Darum hatte Frau Hadwig den alten Herzog in Schwaben genommen ihrem Vater zu Gefallen,[17] hatte ihn auch gehegt und gepflegt, wie es einem grauen Haupt zukam, aber wie der Alte zu ſterben ging,[18] hat ihr der Kummer das Herz nicht gebrochen.

J. V. von Scheffel.

NOTES:—

(1) mag's, mag es. (2) der Erdrinde, genitive dependent on Spalten. (3) noch immer, *still*. (4) mit feurigem Kern im Herzen. This cannot be translated literally; the author is thinking, on the one hand, of the molten masses in the heart of the earth which in volcanic upheavals force their way out and alter the configuration of the land; on the other hand, he alludes to the glowing moral forces and resolves which lead men to break through the barriers of law and convention. It may be rendered by "animated by fiery and volcanic energy." (5) ſäße, ſitzen is here used in the sense of to be lodged. (6) drin colloquial abbreviation for darin. (7) entgegen gejubelt, the auxiliary haben must be

supplied with the Past Participle. Entgegen gives the idea of meeting or welcoming, and entgegen jubeln may be translated by "greeting with jubilation or exultation." (8) Burg in apposition to Thurm und Mauern. (9) dabei, *hence*. (10) Normänner, the more ordinary plural is Normannen. (11) werfen, here used in the sense of overthrow. (12) etwann, a formation like etwas; it is no longer in use; it means "at some time or other." (13) widerſpänſtig, in modern German written widerſpenſtig. (14) war, in South Germany and Austria the auxiliary ſein is used with the verbs ſitzen and ſtehen, whereas in North Germany haben is used. (15) kaum zu ertragender, *hardly to be borne with*. (16) zur Neige gehen, *to wane*. (17) ihrem Vater zu Gefallen, *to please her father*. (18) zu ſterben ging, *came to die*.

VOCABULARY

sight, Sicht, w.f.
issue, kommen, s.
rise, aufſteigen, s. sep.
visible, ſichtbar.
be bent on, erpicht ſein auf.
across, über.
cast, werfen, s.
glance, Blick, s.m.2.
surround, umgeben, s. insep.
wall, Mauer, w.f.
corner, Winkel, s.m.1.
northern, nördlich.
wide, breit.
gateway, Tor, s.n.2.
ground, Boden, s.m.1.
gently, ſanft.
abundant, üppig.
copsewood, Unterholz, s.m.
oak, Eiche, w.f.
acre, Morgen, s.m.1.
keep, Hauptfeſte, w.f.
conical, kegelförmig.
ruin, Trümmer, w.f. pl.
remains, Reſt, s.m,2.
build, bauen, w.
style, Stil, s.m.2.
window-hole, Fenſterhöhle, w.f.
but, als.
project, hervorſtehen.
blacken, ſchwärzen, w.
rage, wüten, w.
about, um . . . herum.
wonder, wundern, w. impers. gov. acc.
sound, Geräuſch, s.n.2.
smoke, Rauch, s.m.
roof, Dach, s.n.3.
look, ausſehen, s. sep.
adventure, Abenteuer, s.n.1.
occasionally, gelegentlich.
startled, ängſtlich
close to it, dicht dabei.
quadrangular, viereckig, vierwinklig.
square, viereckig.
entrance, Eingang, s. m.2.
side, Seite, w.f.
lofty, hoch.
similar, ähnlich gov. dat.
slope, abfallen, s. sep.
skirt, umgeben, s. insep.
growth, Gewächs, s.n.2.
evergreen, immergrün.
enclosure, Raum, s.m.2.
round, rund.
donjon, Kerker, s.n.1.
strew, bedecken, w.
close to, dicht neben.
oblong, länglich.
modern, modern.
various, verſchieden.
remain, übrig bleiben, s.
bare, nackt.
beam, Balken, s.m.1.
burn, abbrennen, w. sep.
as if, wie.
outside, Außenſeite, w.f.
portentously, ſchrecklich, gräslich.
go on, vorgehen, s. sep.

Exercise 78 (*continued from* 76)

The village was within[1] sight, it is true[2]; but it might be a village of the dead[3] for what[4] I knew; no sound issued from it,[5] no smoke was rising from its[6] roofs, neither man nor beast was visible, no life, no motion—it looked as desolate as the castle itself. Yet I was bent on the adventure, and moved[7] on towards the castle across the green plain, occasionally casting[8] a startled glance around me; and now I was close to it.

It was surrounded by a quadrangular wall, about ten feet in height,[9] with a square tower at each corner. At first I could discover no entrance; walking[10] round, however, to the northern side, I found a wide and lofty gateway with a tower above it, similar to those at[11] the angle of the wall; on this side the ground sloped gently down towards[12] the bog, which was here skirted by an abundant growth of copsewood and a few evergreen oaks. I passed[13] through the gateway, and found myself within a square enclosure[14] of about two acres. On one side rose a round and lofty keep, or donjon,[15] with a conical roof, part of which had fallen down, strewing[16] the square[17] with its ruins. Close to the keep, on the other side, stood the remains of an oblong house, built something[18] in the modern style, with various window-holes; nothing remained but the bare walls, and a few projecting stumps[19] of beams, which seemed to have been half-burnt. The interior[20] of the walls was blackened as if by fire; fire also appeared at one time to have raged out of the window-holes, for the outside about them was black, portentously so.[21] "I wonder what has been going on[22] here?" I exclaimed.

G. H. Borrow.

NOTES:—

(1) *Within*, in. (2) *It is true*, place this after the verb. (3) The German equivalent is Todtenſtadt, town of the dead. (4) *For what I knew*, ſo viel ich wußte (as much as I knew); say, "but, for what I knew, it might have been, etc." (5) *From it*, dorther. (6) *Its*, say *the*. (7) *Moved*, say *went*. (8) *Casting*, say *while* (indem) *I cast*. (9) *In height*, say *high*. (10) *Walking*, say *when* (als) *I walked*. (11) *At*, an. (12) *Towards*, nach. (13) *Passed*, say *went*. (14) *Enclosure*, here ein eingehegtes Grundſtück (an enclosed piece of ground); *found myself*, use ſich befinden. (15) Donjon, the indefinite article must be repeated before this, as it is not the same gender as Hauptfeſte. (16) *Strewing*, say *and had strewed*. (17) *Square*, here Hof (courtyard). (18) *Something*, mehr oder weniger (more or less). (19) *Stumps of beams*, Balkenreſte. (20) *Interior of the walls*, say *inside walls*, Innenwände. There is a difference between Mauer and Wand, the former is used for outside walls of brick or stone, the latter for inside walls. (21) *So*, repeat the word *black* instead of using *so*. (22) vorgehen being a compound of a verb of motion, is conjugated with the auxiliary ſein.

Key to Exercise 75

It was nearly a thousand years ago. The world knew nothing of either gunpowder or printing.

A sombre, leaden sky overhung the district of Hegau, but of the darkness, which, as is well known, weighed upon the whole Middle Ages, nothing in particular (singly) was to be seen. From the direction of Lake Constance the mists surged over the Ries, and hid the country and the people. The tower, too, of the new abbey Radolfzelle was shrouded in mist, but the Matins bell had sounded gaily through mist and fog (steam) as the speech of a wise man pierces the obscurity of fools (as the word of a wise man through the darkening fog of fools).

It is a beautiful piece of German land which opens out there between the Black Forest and the Swabian Sea. He who is not too particular about a false metaphor may remember the words of the poet:

The land of the Alemanni, with the snow of its mountains,
With its blue eye, the clear Lake of Constance,
With its yellow hair, the corn which adorns its plains (the adornment of ears of its plains),
Such land is very like a German face to look upon.

Although the continuation of this metaphor might lead one to laud the mountains of Hegau as the noses of this face (might become a suggestion to laud, etc.). Sombrely the summit of the high Twiel with its jagged edges of clink stone towered in the air. As a monument of the stormy, early history of our old Mother Earth, those steep, picturesque mountain cones stand in the valley which once, like the present basin of the lake, was flooded with surging water.

Key to Exercise 76

Von den Fenſtern des Zimmers, worin ich ſchlief, hatte ich eine Ausſicht auf eins dieſer alten Schlöſſer — zwar eine unklare, denn die Entfernung war zu groß als daß ſie es einem ermöglichte mehr als den allgemeinen Umriß zu unterſcheiden. Mich verlangte ſehr daſſelbe zu unterſuchen. Es lag gegen Südoſten; in dieſer Richtung, aber, befand ſich ein ſchwarzer Moraſt, welcher mehr als einmal alle meine Verſuche, denſelben zu überſchreiten, vereitelt hatte. Doch eines Morgens, als die Sonne hell auf das alte Gebäude ſchien, erſchien es ſo nahe, daß ich mich ſchämte ein ſcheinbar ſo leichtes Unternehmen nicht ausführen zu können; ich beſchloß alſo noch einen Verſuch zu machen.

Ich erreichte den Moraſt, und war im Begriff mich auf deſſen ſchwarze Oberfläche zu wagen, und Schritt für Schritt meinen Weg zwiſchen den zahlloſen, entſetzlich gähnenden Vertiefungen, die halb mit Waſſer ſchwarz wie Ruß, angefüllt waren, zu ſuchen, als es mir plötzlich einfiel, daß es eine Straße gegen Süden gab, und daß, wenn ich dieſe verfolgte, ich einen bequemeren Weg nach dem Ziel meiner Wünſche finden könnte. Die Folge rechtfertigte meine Erwartungen, denn, nachdem ich einige drei Meilen die Straße verfolgt hatte, ſcheinbar in der Richtung des Teufels-Berges, erblickte ich plötzlich das Schloß zur Linken.

M. A. L.

RUSSIAN—XXIX

Russian Commercial Correspondence

A—Commencements of Letters

Симъ позволя́ю себѣ́,	*Herewith I take the liberty to . . .*
Симъ беру́ себѣ́ свобо́ду,	*Herewith I take the liberty to . . .*
Симъ честь имѣ́ю,	*Herewith I have the honour of . . .*
Симъ осмѣ́ливаюсь,	*Herewith I venture to, beg leave to . . .*
Ссыла́ясь на . . .	*Referring to . . . , with reference to . . .*
Возвраща́ясь къ . . .	*Reverting to . . .*
Въ отвѣ́тъ на . . .	*In reply to . . .*
Согла́сно Ва́шему почтѣ́нному письму́ . . .	*In accordance with your letter . . .*
Идя на встрѣ́чу Ва́шему жела́нію . . .	*In compliance with your wishes . . .*
Настоя́щимъ спѣшу́ довести́ до Ва́шего свѣ́дѣнія . . .	*I hasten herewith to inform you . . .*
Настоя́щимъ честь имѣ́ю Васъ извѣсти́ть . . .	*By this I have the honour of informing you . . .*
Настоя́щимъ имѣ́ю удово́льствіе . . .	*Herewith I have pleasure in . . .*
Симъ подтвержда́ю получе́ніе В/. письма́ отъ . . .	*I beg to acknowledge the receipt of your letter of . . .*
Симъ обраща́юсь къ Вамъ . . .	*I beg to apply to you . . .*
Удостовѣря́я получе́ніе В/. письма́ отъ . . .	*In acknowledging receipt of your letter . . .*
По рекоменда́ціи . . .	*On the recommendation of . . .*
Полага́ясь на Ва́шу любе́зность . . .	*Relying on your kindness . . .*
Къ кра́йнему моему́ сожалѣ́нію я вы́нужденъ,	*To my very great regret I am compelled to . . .*
Для Ва́шего свѣ́дѣнія могу́ Вамъ сообщи́ть . . .	*For your guidance I may inform you . . .*
Подтвержда́я на́ше письмо́ отъ 10-го с./м . . .	*Confirming our letter of 10th instant . . .*
Для поря́дка честь имѣ́ю напо́мнить Вамъ . . .	*For the sake of order I beg to remind you . . .*

B—Terminations of Letters

Зара́нѣе благодарю́ Васъ за любе́зный отвѣ́тъ и пребыва́ю

Съ соверше́ннымъ почте́ніемъ

I tender you my thanks in anticipation for your kind reply, and am

Yours faithfully,

Остаю́сь

Съ и́стиннымъ уваже́ніемъ (with sincere esteem)

I remain,

Yours faithfully,

Въ ожида́ніи Ва́шего благосклонна́го отвѣ́та . . . (in the expectation of, etc.)

Anticipating your favourable reply . . .

Пребыва́ю гото́вый къ услу́гамъ . . .

I remain at your disposal . . .

Гото́вый къ взаи́мнымъ услу́гамъ . . .

Ready to reciprocate . . .

Въ заключе́ніе честь имѣ́ю увѣ́рить Васъ въ истинномъ моемъ уваженіи

In conclusion, I beg to assure you of my sincere esteem

Надѣ́ясь на Вашъ ско́рый уважа́емый отвѣ́тъ, пребыва́ю

Благода́рный Вашъ . . .

Relying upon your esteemed early reply, I am,

Yours thankfully,

Приме́те увѣре́ніе въ моёмъ глубо́комъ уваже́ніи

Accept the assurance of my high esteem.

Приме́те увѣре́ніе въ то́чномъ соблюде́ніи Ва́шихъ интере́совъ

Accept the assurance of my strict observance of your interests.

Приме́те увѣре́ніе въ моёй пре́данности къ Ва́шимъ интере́самъ

Accept the assurance of my devotion to your interests.

Standard Forms of Russian Business Letters

1—Invitation to a Cup of Tea

Симъ приглаша́ю Васъ на ча́шку ча́ю въ мое́й ча́стной кварти́рѣ въ во́семь часо́въ сего́дня ве́черомъ. Моя́ жена́ и де́ти ждутъ Васъ съ нетерпѣ́ніемъ. Мы бу́демъ та́кже имѣ́ть и у́жинъ вмѣстѣ́. При слу́чаѣ потолку́емъ о дѣла́хъ, е́сли бу́детъ возмо́жно. Шлю Вамъ мой раду́шнѣйшій привѣ́тъ.

I beg to invite you to a cup of tea at my private residence at eight o'clock this evening. My wife and children await you impatiently. We shall also have supper together, and at the same opportunity a chat about business, if possible.

I am sending you my heartiest welcome.

2—Invitation to Inspect Samples

Приве́зши съ собо́ю большо́й вы́боръ новосте́й, симъ почти́тельнѣйше приглаша́ю Васъ посѣти́ть меня́ въ гости́ницѣ . . . , въ удо́бное для Васъ вре́мя, для разсмотрѣ́нія мои́хъ образцо́въ. Я простою въ Ва́шемъ го́родѣ до 20-го числа́ сего́ мѣ́сяца.

Having brought over with me a large selection of novelties, I most respectfully invite you herewith to see me at the . . . Hotel, at any time to suit your convenience, for inspecting my samples. I shall stay in your town up to the 20th instant.

3—Application for a Situation

Узна́въ, что у Васъ откры́лась вака́нсія на до́лжность бухга́льтера и корреспонде́нта, симъ спѣ́шу предложи́ть Вамъ мой поко́рнѣйшія услу́ги.

As it has been brought to my knowledge that there is a vacancy of the post for a book-keeper and correspondent in your firm, I hasten herewith to offer you most humbly my services.

Изъ прило́женныхъ при семъ аттеста́товъ соблагово́лите усмотрѣ́ть, что я вполнѣ́ компете́нтенъ для ска́занной до́лжности, а о моемъ хара́ктерѣ и нра́вственности позволя́ю себѣ́ сосла́ться на слѣ́дующія фи́рмы, кото́рыя, надѣ́юсь, ли́чно зна́ютъ меня́ съ са́мой лу́чшей стороны́.

From the enclosed testimonials you may kindly note that I am quite competent for the said post, and as to my character and morals, I beg to refer to the following firms, which, I hope, personally know me from the best side.

Смѣю увѣ́рить Васъ, что по удосто́еніи меня́ Ва́шимъ весьма́ уважа́емымъ довѣ́ріемъ я бу́ду прилага́ть всѣ́ческія стара́нія къ по́лному оправда́нію и заслуже́нію такова́го въ полнѣ́йшей мѣ́рѣ.

I beg to assure you that on honouring me with your highly esteemed confidence I shall direct all my efforts towards justifying and deserving same in the fullest measure.

4—Answer to Letter No. 3

Серде́чно благодарим̀ъ Васъ за любе́зное предложе́ніе. Мы, одна́кожъ, не мо́жемъ воспо́льзоваться таковы́мъ, такъ какъ спра́шиваемое мѣ́сто уже́ замѣ́щено́.

We sincerely thank you for the kind offer. We are, however, unable to avail ourselves of same, the post in question having been already filled.

5—Another Answer to Letter No. 3

Спра́шиваемая вака́нсія ещѐ откры́та у насъ. Благово́льте яви́ться въ на́шу конто́ру за́втра въ де́сять часо́въ утра́ для ли́чныхъ перегово́ровъ.

The vacancy in question is still open with us. Please give us a call at our office to-morrow morning at ten o'clock for a personal interview.

6—Application for an Agency

Симъ честь имѣ́ю обрати́ться къ Вамъ съ про́сьбой о предоставле́ніи мнѣ че́сти представле́нія Ва́шей фи́рмы въ семъ го́родѣ. Мои́ обши́рныя свя́зи съ э́тимъ кра́емъ су́лятъ мнѣ возмо́жность достиже́нія большо́го успѣ́ха по распростране́нію Ва́шихъ това́ровъ.

I beg to apply to you asking you to grant me the honour of representing your firm in this town. My extensive connections with this district offer me the possibility of attaining a great success in pushing your articles.

7—Answer to Letter No. 6

На́ше гла́вное представи́тельство на всю Россію съ пра́вомъ назначе́нія субъ-а́гентовъ бы́ло ввѣрено́ на́ми фи́рмѣ NN . . . въ Петрогра́дѣ, къ кое́й покорнѣ́йше про́симъ Васъ обрати́ться за свѣ́дѣніями по интересу́ющему Васъ вопро́су.

Our chief agency for the whole of Russia with the right of appointing sub-agencies has been entrusted by us to the firm NN., of Petrograd, to which kindly apply for further information on the question that interests you.

8—Another Answer to Letter No. 6

По́ поводу Ва́шего почтѣ́наго письма́ отъ . . . , за кото́рое спѣ́шимъ вы́разить Вамъ на́шу и́скреннюю благода́рность, мы поручи́ли на́шему Петрогра́дскому представи́телю свида́ться съ Ва́ми ли́чно для перегово́ровъ.

On account of your esteemed letter of . . . , for which we hasten to express our sincere gratitude to you, we have directed our Petrograd representative to see you personally with a view to pour-parlers (negotiations).

9—Application for Granting the Exclusive Sale

Жела́я получи́ть отъ Васъ еди́нственную прода́жу Ва́шего но́ваго ве́львета на весь Югъ Россіи, покорнѣ́йше про́симъ Васъ сообщи́ть Ва́ши усло́вія.

Desirous of having the exclusive sale of your new velvet for the whole of the South of Russia, we beg to apply for your terms.

Lineal Measure

Russian		*English Equivalents*	*French Equivalents*
1 ми́ля	7 вёрстъ	4.641 miles	7.469 kilometres.
1 верста́	500 сажёнъ	0.663 mile	1.067 ,,
1 са́жень	3 арши́на or 7 фу́товъ	7.000 feet	2.134 metres.
1 арши́нъ	16 вершко́въ	0.778 yard	0.711 metre.
1 футъ	12 дю́ймовъ	1.000 foot	0.305 ,,
1 дюймъ	10 ли́ній	1.000 inch	2.540 centimetres.
1 верш́окъ		1.750 inches	4.445 ,,

Square Measure

1 десяти́на	2400 кв. сажёнъ	2.700 acres	1.092 hectares.
1 кв. саж.	9 кв. арши́нъ or 49 кв. фут.	49.000 sq. feet	4.554 sq. metres.
1 кв. арши́нъ	256 кв. вершко́въ.	0.605 sq. yard	0.506 sq. metre.
1 кв. футъ	144 кв. дюйм.	1.000 sq. foot	0.093 ,, ,,
1 кв. дюймъ		1.000 sq. inch	6.451 sq. centimetres.
1 кв. верш́окъ.		3.062 sq. inches	19.758 ,, ,,

Cubic Measure

1 куб. са́жень	27 куб. арш. or 343 куб. фут.	343 cub. feet	9.718 cub. metres.
1 куб. арши́нъ	4096 куб. вершко́въ,	12.704 ,, ,,	0.359 cub. metre.
1 куб. футъ	1728 куб. дюйм.	1.000 cub. foot	0.028 ,, ,,
1 куб. дюймъ		1.000 cub. inch	16.387 cub. centimetres.
1 куб. верш́окъ,		5.358 cub. inches	87.824 ,, ,,

Dry Measure

1 ластъ	12 четверте́й	8.662 quarters	25.166 hectolitres.
1 че́тверть	2 осьми́ны	5.775 bushels	2.097 ,,
1 осьми́на	4 четверика́	2.887 ,,	1.049 ,,
1 четвери́къ	8 га́рнцевъ	5.775 gallons	2.621 decalitres.
1 га́рнецъ		0.722 gallon	3.277 litres.

Liquid Measure

1 Бо́чка	40 ве́деръ	3.008 barrels	4.916 hectolitres.
1 ведро́	8 што́фовъ or 10 кру́жекъ,	2.707 gallons	12.290 litres.
1 кру́жка	10 ча́рокъ,	1.083 quarts	1.229 ,,
1 штофъ		1.3535 ,,	1.536 ,,
1 ча́рка		0.886 gill	0.1229 litre

Weights

1 Бе́рковецъ	10 пудо́въ	3.224 hundredweights	163.800 kilogrammes.
1 пудъ	40 фу́нтовъ	36.113 pounds	16.380 ,,
1 фунтъ	32 ло́та	0.903 pound	0.410 kilogramme.
1 лотъ	3 золотника́	0.451 ounce	12.797 grammes.
1 золотни́къ	96 до́лей	0.150 ,,	4.266 ,,

Other Measures

1 гроссъ	12 дю́жинъ	One gross 12 dozens.
1 стопа́	20 дете́й	One ream 20 quires.
1 десть	24 листа́	One quire 24 sheets.
1 дра́хма	3 скрупу́ла	One drachm 3 scruples.
1 скрупу́лъ	20 гранъ	One scruple 20 grains.
1 кара́тъ	4½ до́ли	One carat 3.2 troy grains.

Gold Coins

1 импери́алъ	10 рубле́й
1 по́луимпери́алъ	5 рублей

Silver Money

1 рубль 100 копе́екъ.

Silver Coins

The following are the current Russian silver coins:

Of 5, 10, 15, 20, 25, 50 copecks, and of 1 rouble.

Copper Coins

These are in 5, 3, 2 copecks, 1 copeck, ½ copeck (де́нежка), and ¼ copeck (полу́шка).

Paper Money

Of this there are in circulation: credit notes of the State Bank (Креди́тные Биле́ты Госуда́рственнаго Ба́нка) in 1, 3, 5, 10, 25, 50, and 100 rouble notes. Before August, 1914—i.e. previous to the War—the official value was: 1 rouble = 2s. 1d.; 1 copeck = 1 farthing. A. C.

GREEK.—XVI

Irregular Verbs

I.—The following verbs having stems in -ῠ lengthened their stems in the present to -ευ, which became -ϵϝ- before a vowel, the digamma then dropping and leaving ϵ, thus θῠ-, θευ-, θϵϝω, θέω, *run.*

Present.	*Future.*	*Aorist.*	*Perfect.*
θέω, *run* (stem θῠ-)	θεύσομαι		
νέω, *swim* (νῠ-)	νεύσομαι or νευσοῦμαι	ἔνευσα	νένευκα
πλέω, *sail* (πλῠ-)	πλεύσομαι or πλευσοῦμαι	ἔπλευσα	πέπλευκα or πέπλευσμαι
πνέω, *breathe* (πνῠ-)	πνεύσομαι or πνευσοῦμαι	ἔπνευσα	πέπνευκα
ῥέω, *flow* (ῥῠ-)	ῥεύσομαι Attic, ῥυήσομαι	ἔρρευσα Attic, ἐρρύην	ἐρρύηκα
χέω, *pour* (χῠ-)	χεῶ pass. ἐχῠ́θην	ἔχεα	κέχῠμαι

With these may be grouped two verbs in -αιω with stems in -αο, which became -αϝι and then -αι, thus καο-, καϝιω, καίω, *burn.*

καίω (Attic κάω), *burn* (καο-)	καύσω, pass. καυθήσομαι	ἔκαυσα, 1st pass. ἐκαύθην	κέκαυκα, κέκαυμαι
κλαίω (Attic κλάω), *weep* (κλαο-)	κλαύσομαι (or κλαιήσω or κλᾱ́σω)	ἔκλαυσα	κέκλαυμαι

II.—In the next group of verbs the stem is lengthened by the addition of ϵ to form the present stem.

Present.	*Future.*	*Aorist.*	*Perfect.*
γαμέω, *marry* (γᾰμ-)	γαμῶ (γαμέω) mid. γαμοῦμαι, *shall be married* (of the woman)	ἔγημα ἐγημάμην	γεγάμηκα pass. γεγάμημαι
δοκέω, *seem* (δοκ-) imper. δοκεῖ, *it seems good*	δόξω	ἔδοξα	
ὠθέω, *push* (ὠθ-)	ὤσω mid. ὤσομαι pass. ὠσθήσομαι	ἔωσα ἐωσάμην ἐώσθην	ἔωσμαι

III.—In the following ϵ (or η) is added to the stem in all tenses other than the present and imperfect:—

Present.	*Future.*	*Aorist.*	*Perfect.*
ἄχθομαι, *am vexed*	ἀχθέσομαι pass. ἀχθεσθήσομαι	ἠχθέσθην	
βόσκω, *feed*	βοσκήσω		
βούλομαι, *wish, be willing,* imperf. ἐβουλόμην or ἠβουλόμην	βουλήσομαι	ἐβουλήθην or ἠβουλήθην	βεβούλημαι
γίγνομαι (or γιγένομαι), *become* (γεν-, γα-)	γενήσομαι	2nd mid. ἐγενόμην	2nd γέγονα, *am,* γεγένημαι
δέω, *lack, want,* impers. δεῖ, *it is necessary*	δεήσω δεήσει	ἐδέησα ἐδέησε	δεδέηκα
mid. δέομαι, *need*	δεήσομαι	ἐδεήθην	δεδέημαι
ἐθέλω and θέλω, *wish,* imperf. ἤθελον	ἐθελήσω, θελήσω	ἠθέλησα	ἠθέληκα
[ἔρομαι (not in use)], *ask* (ἐρ-)	ἐρήσομαι	ἠρόμην	
ἕψω, *cook*	ἑψήσω mid. ἑψήσομαι	ἥψησα	
μάχομαι, *fight*	μαχοῦμαι	ἐμαχεσάμην	μεμάχημαι
μέλλω, *intend, be about to,* imperf. ἔμελλον or ἤμελλον	μελλήσω	ἐμέλλησα	
[μέλω, *concern*] impers. μέλει, *it concerns*	μελήσει	ἐμέλησε	μεμέληκε
mid. μέλομαι (in prose ἐπιμέλομαι), *care for*	ἐπιμελήσομαι		ἐπιμεμέλημαι
μένω, *remain*	μενῶ	ἔμεινα	μεμένηκα
οἴομαι (in prose usually οἶμαι), *think*; 2nd. s. οἴει, imperf. ᾤμην (ᾠόμην)	οἰήσομαι	ᾠήθην	
οἴχομαι, *am gone,* imperf. ᾠχόμην	οἰχήσομαι		
ὀφείλω, *owe, ought, must* (ὀφελ-)	ὀφειλήσω	ὠφείλησα 2nd ὤφελον, O that (Latin *utinam*)	
πέτομαι, *fly* (πετ-, πτ-)	πτήσομαι	2nd ἐπτόμην	
χαίρω, *rejoice* (χαρ-)	χαιρήσω	2nd. pass. ἐχάρην	κεχάρηκα κεχάρημαι

IV.—The fourth group comprises verbs in which the simple stem is strengthened in the present tense by the addition of ν. Those in one section of this group add ᾰν, a few others add νϵ, and verbs of the second class of those in -μι add νυ (ννυ after a vowel).

(*a*) Among those adding ν are:—

Present.	*Future.*	*Aorist.*	*Perfect.*
βαίνω, *go* (βᾰ-, βᾰν-)	βήσομαι	ἔβην (cp. ἔστην § 116)	βέβηκα
δάκνω, *bite* (δακ-, δηκ-)	δήξομαι pass. δηχθήσομαι	ἔδᾰκον ἐδήχθην	δέδηχα δέδηγμαι
ἐλαύνω (for ἐλανύω), *drive* (ἐλᾰ-)	ἐλῶ (ἐλάσω)	ἤλᾰσα pass. ἠλᾰ́θην	ἐλήλᾰκα ἐλήλᾰμαι
τίνω, *pay* (τι-)	τίσω	ἔτῑσα pass. -ἐτίσθην	τέτῑκα -τέτισμαι

Observe that βαίνω lengthens the stem-vowel α to αι, and ἐλαύνω to αυ.

(*b*) In the following the syllable ἄν is added to a consonantal stem :—

Present.	*Future.*	*Aorist.*	*Perfect.*
αἰσθάνομαι, *perceive* (αἰσθ-)	αἰσθήσομαι	2nd mid. ἠσθόμην	ἤσθημαι
ἁμαρτάνω, *fail, err* (ἁμαρτ-)	ἁμαρτήσομαι	ἥμαρτον	ἡμάρτηκα
	pass.	ἡμαρτήθην	ἡμάρτημαι
ἀπεχθάνομαι, *am hated* (ἐχθ-)	ἀπεχθήσομαι	ἀπηχθόμην	ἀπήχθημαι
αὐξάνω and αὔξω, *increase* (n.) (αὐξ-)	αὐξήσω pass. αὐξήσομαι	ηὔξησα ηὐξήθην	ηὔξηκα ηὔξημαι
δαρθάνω, *sleep* (δαρθ-)	καταδαρθήσομαι	κατέδαρθον	
ὀλισθάνω (rarely ὀλισθαίνω), *slip* (ὀλισθ-)	ὀλισθήσω	ὤλισθον	ὠλίσθηκα
ὀσφραίνομαι, *smell* (ὀσφρ-)	ὀσφρήσομαι	ὠσφρόμην	

The following verbs of this group show how a nasal (*ν*, *γ*, or *μ*) is inserted after a short vowel in the simple stem, thus λᾰθ- becomes λανθ-, λανθαν-, λανθάνω, *escape notice.*

θιγγάνω, *touch* (θῐγ-)	θίξομαι	ἔθιγον	
λαμβάνω, *take* (λᾰβ-)	λήψομαι	ἔλαβον	εἴληφα
		mid. ἐλαβόμην	εἴλημμαι
	pass. ληφθήσομαι	ἐλήφθην	
λανθάνω, *escape notice* (λᾰθ-, ληθ-)	λήσω	ἔλαθον	λέληθα
mid. ἐπιλανθάνομαι, *forget*	ἐπιλήσομαι	ἐπελαθόμην	ἐπιλέλησμαι

(*c*) In the following the stem is strengthened by the addition of νε :—

Present.	*Future.*	*Aorist.*	*Perfect.*
βῡνέω or βύω, *stop up* (βυ-)	βῡσω	ἔβῡσα	
		pass. ἐβύσθην	βέβυσμαι
ἱκνέομαι (in prose usually ἀφικνέομαι) (-ἱκνοῦμαι), *arrive.*	ἀφίξομαι	2nd mid. ἀφικόμην	ἄφιγμαι
ὑπισχνέομαι *promise* (σεχ-, σχη-, σχ-, *cp.* ἔχω)	ὑποσχήσομαι	2nd mid. ὑπεσχόμην	ὑπέσχημαι

V.—The next group of verbs form the present stem by adding σκ (or ισκ after a consonant) to the simple stem. Some of these, it will be noticed, take a reduplication in the present and imperfect, as γιγνώσκω, διδράσκω, μιμνήσκω, πιπράσκω, and τιτρώσκω.

Present.	*Future.*	*Aorist.*	*Perfect.*
ἅλίσκομαι, *be captured* (ἁλ-, ἁλο-)	ἁλώσομαι	ἥλων or ἐάλων (with passive meaning)	ἥλωκα or ἐάλωκα
ἀναλίσκω or ἀνᾱλόω, *spend* (ἁλ-, ἁλο-)	ἀνᾱλώσω	ἀνήλωσα or ἀνᾱλωσα	ἀνήλωκα or ἀνᾱλωκα
		pass. ἀνηλώθην or ἀνᾱλώθην	ἀνήλωμαι or ἀνᾱλωμαι
ἀρέσκω, *please* (ἀρε-)	ἀρέσω	ἤρεσα	
		pass. ἠρέσθην	ἤρεσμαι
γηράσκω or γηράω, *grow old* (γηρα-)	γηράσω γηράσομαι	ἐγήρᾱσα	γεγήρᾱκα, *am old*
γιγνώσκω, *know* (γνω-)	γνώσομαι	ἔγνων, *perceived*	ἔγνωκα
	pass. γνωσθήσομαι	ἐγνώσθην	ἔγνωσμαι
-διδράσκω (in ἀποδιδράσκω, *run away*), *run* (δρα-)	ἀποδρᾶσομαι	ἀπέδρᾱν	ἀποδέδρᾱκα
εὑρίσκω, *find* (εὑρ-)	εὑρήσω	εὗρον or ηὗρον mid. εὑρόμην	εὕρηκα εὕρημαι
θνήσκω (in Attic prose ἀποθνήσκω), *die* (θᾰν-, θνᾰ-)	ἀποθανοῦμαι fut. perf. τεθνήξω or τεθνήξομαι, *shall have died*	ἀπέθανον	τέθνηκα
θρώσκω, *spring* (θορ-, θρο-)	θοροῦμαι	ἔθορον	
ἱλάσκομαι, *propitiate* (ἱλᾰ-)	ἱλάσομαι	ἱλάσάμην pass. ἱλάσθην	
μιμνήσκω (in prose ἀναμηήσκω), *remind* (μνᾰ-)	ἀναμνήσω	ἀνέμνησα	
mid. μιμνήσκομαι, *remember*	pass. μνησθήσομαι fut. perf. μεμνήσομαι	ἐμνήσθην	μέμνημαι
πάσχω, *suffer* (παθ-, πενθ-)	πείσομαι (for πένθσομαι)	ἔπαθον	
πιπράσκω, *sell* (περᾱ-, πρᾱ-)	fut. perf. pass. πεπρᾶσομαι	ἐπρᾱθην	πέπρᾱκα πέπρᾱμαι
τιτρώσκω, *wound* (τρο-)	τρώσω pass. τρωθήσομαι	ἔτρωσα pass. ἐτρώθην	τέτρωκα pass. τέτρωμαι
χάσκω, *yawn* (χᾰν-)	χανοῦμαι	ἔχᾰνον	κέχηνα, *stand open*

Note that the perfect μέμνημαι (*see* μιμνήσκω) has an inflected irregularity in subjunctive, as follows :—μέμνωμαι, -ῃ, -ηται, etc., and in the optative, μεμνῴμην, -ῷο, -ῷτο, etc., or μεμνῇμην, -ῇο, -ῇτο, etc., imper. μέμνησο, infin. μεμνῆσθαι.

VI.—The following verbs form their tenses from entirely different stems :—

Present.	*Future.*	*Aorist.*	*Perfect.*
αἱρέω (Attic αἱρῶ), *take* (αἱρε-, ἑλ-)	αἱρήσω	εἷλον subj. ἕλω	ᾕρηκα
		mid. εἱλόμην, subj. ἕλωμαι	ᾕρημαι
	pass. αἱρεθήσομαι	ᾑρέθην	
ἔρχομαι, *go, come* (ἐρχ-, ἐλῡθ-, ἐλευθ-, ἐλθ-)	poet. ἐλεύσομαι (εἶμι is used in prose)	ἦλθον	ἐλήλυθα
ἐσθίω, *eat* (ἐσθι-, ἐδ-, φᾰγ-)	ἔδομαι	ἔφαγον pass. ἠδέσθην	ἐδήδοκα ἐδήδεσμαι
ὁράω, *see* (ὁρα-, ὀπ-, ἰδ-) imperf. ἑώρων	ὄψομαι	εἶδον, subj. ἴδω, opt. ἴδοιμι, imper. ἴδε or ἰδέ, infin. ἰδεῖν, part. ἰδών	ἑώρᾱκα or ἑόρᾱκα
	pass. ὀφθήσομαι	ὤφθην	ἑώρᾱμαι οἶ ὦμμαι, ὄψαι

Present.	*Future.*	*Aorist.*	*Perfect.*
πίνω, *drink* (πι-, πο-)	πίομαι	ἔπῐον pass. ἐπόθην	πέπωκα πέπομαι
τρέχω, *run* (τρεχ- for θρεχ-, δρᾰμ-)	δραμοῦμαι	ἔδραμον	δεδράμηκα
φέρω, *bear* (φερ-, οἰ-, ἐνεκ-, ἐνεγκ-)	οἴσω	1st ἤνεγκα 2nd ἤνεγκον	ἐνήνοχα
	mid. οἴσομαι	mid. ἠνεγκάμην	ἐνήνεγμαι -γξαι, -γκται or -εκται, etc.
	pass. ἐνεχθήσομαι or οἰσθήσομαι	ἠνέχθην	

VII.—Finally, we have a group of verbs in -ω, which in the second aorist active follow the analogy of verbs in -μι. The principal are :—

Present.	*Aorist.*
ἁλίσκομαι, *be captured* (ἁλ-, ἅλο-)	ἥλων or ἔαλων, -ως, -ω, etc., *was captured* subj. ἁλῶ, -ῷς, -ῷ, etc. opt. ἁλοίην, infin. ἁλῶναι, part. ἁλούς
βαίνω, *go* (βᾰ-)	ἔβην, subj. βῶ, opt. βαίην, imper. βῆθι (-βᾱ), infin. βῆναι, part. βάς
βιόω, *live* (βιω-)	ἐβίων, subj. βιῶ, opt. βιώην (not βιοίην), infin. βιῶναι, part. βιούς
γιγνώσκω, *know* (γνω-)	ἔγνων, subj. γνῶ, γνῷς, γνῷ, etc., opt. γνοίην, imper. γνῶθι, γνώτω, γνόντων, etc., infin. γνῶναι, part. γνούς
δύω, *enter, put on* (δυ-)	ἔδῡν, subj. δύω, imper. δῦθι, infin. δῦναι, part. δύς
κτείνω, *kill* (κτα-, κτεν-)	(poetic) ἔκτᾰν, -τᾰς, -τᾰ, -τᾰμεν, etc.
σκέλλω, *dry up* (σκελ-, σκλε-)	ἔσκλην, inf. ἀποσκλῆναι
[τλάω], *endure* (τλα-), fut. τλήσομαι	ἔτλην, subj. τλῶ, opt. τλαίην, imper. τλῆθι, infin. τλῆναι, part. τλάς
φθάνω, *anticipate* (φθα-)	ἔφθην, subj. φθῶ, opt. φθαίην, infin. φθῆναι, part. φθάς
φύω, *bring forth* (φυ-)	ἔφῡν, *was born*, subj. φύω, infin. φῦναι, part. φύς

Defective Verbs

The verb οἶδα, *know* (stem *Fιδ-*, ἰδ, cp. εἶδον), is a second perfect without a present tense. It is conjugated as follows :—

PERFECT.

	Indicative.	*Subjunctive.*	*Optative*	*Imperative.*	*Infinitive.*	*Participle.*
Sing.	1. οἶδα	εἰδῶ	εἰδείην		εἰδέναι	εἰδώς, εἰδυῖα, εἰδός
	2. οἶσθα	εἰδῇς	εἰδείης	ἴσθι		
	3. οἶδε(ν)	εἰδῇ	εἰδείη	ἴστω		
Dual	2. ἴστον	εἰδῆτον	εἰδείητον or εἰδεῖτον	ἴστον		
	3. ἴστον	εἰδῆτον	εἰδειήτην or εἰδείτην	ἴστων		
Plur.	1. ἴσμεν	εἰδῶμεν	εἰδείημεν or εἰδεῖμεν			
	2. ἴστε	εἰδῆτε	εἰδείητε or εἰδεῖτε	ἴστε		
	3. ἴσᾶσι(ν)	εἰδῶσι(ν)	εἰδείεν	ἴστων or ἴστωσαν		

PLUPERFECT.

Sing.	1. ᾔδη or ᾔδειν
	2. ᾔδησθα or ᾔδεισθα (ᾔδης or ᾔδεις)
	3. ᾔδει(ν) or ᾔδη
Dual	2. ᾖστον or ᾔδειτον
	3. ᾖστην or ᾠδείτην
Plur.	1. ᾖσμεν or ᾔδειμεν
	2. ᾖστε or ᾔδειτε
	3. ᾔδεσαν or ᾖσαν

FUTURE. εἴσομαι, etc.

The mid. perfect ἔοικα (stem ἰκ-) is similar. It is used in a present sense meaning *resemble, seem*, the present εἴκω not being found. It is thus inflected :—

PERFECT.

	Indicative.	*Subjunctive.*	*Participle.*
Sing.	1. ἔοικα	ἐοίκω, etc.	εἰκώς, εἰκυῖα, εἰκός
	2. ἔοικας		
	3. ἔοικε(ν)	*Optative.*	*Pluperfect.*
Dual	2. ἐοίκατον	ἐοίκοιμι	ἐώκη or ἐώκειν
	3. ἐοίκατον		
Plur.	1. ἔοιγμεν	*Infinitive.*	*Future.*
	2. ἐοίκατε	εἰκέναι	εἴξω (rare)
	3. εἴξᾱσι(ν)		

The 3rd sing. perf. ἔοικε, *it seems*, is in common use as an impersonal verb.

There are both a first perfect δέδοικα and a second perfect δέδια, *fear*, of the stem δι- , of which there was an epic present δείδω, with a future δείσομαι.

VOCABULARY

ἀγανακτέω, *be grieved, annoyed*, or *discontented.*
βραδύς, -εῖα, -ύ, *slow, heavy.*
διαφερόντως, *differently, excessively.*
μελετάω, *care for, attend to, practise.*
μοῖρα, -ας, -ἡ, *part, fate, lot.*
ταχύς, -εῖα, -ύ, *swift.*
ὠφελέω, *help, assist, be of use.*

Exercise 17

(*a*) Translate into English :—

1. Οἶσθά τι οὖν ὑπὸ ἀνθρώπων μελετώμενον ἐν ᾧ οὐ πάντα ταῦτὰ τὸ τῶν ἀνδρῶν γένος διαφερόντως ἔχει ἢ τῶν γυναικῶν ; 2. Σὺ ἄρα, ὡς ἔοικε, τὰ μὲν ὠφελοῦντα χρήματα ἡγεῖ, τὰ δὲ βλάπτοντα οὐ χρήματα. 3. Ἡ καὶ ἐμὲ οὖν, ἔφη ἡ γυνὴ, δεήσει ταῦτα ποιεῖν ; 4. Σὺ δ' ἔοικας τὰ ἑκάστῳ ὠφέλιμα κτήματα καλεῖν. 5. Καὶ βραδὺς εὔβουλος εἶλε ταχὺν ἄνδρα διώκων. 6. Ὀδυσσεὺς πρὸς τὸ μέγα δῶμα Ἄιδου ἦλθεν.

(*b*) Translate into Greek :—

1. You seem to assert, Socrates, that even money is not a commodity unless one knows how to make use of it. 2. And is it right to blame the man for this, or the woman ? 3. And what do you see, said the woman, that I might do to augment the property ? 4. Themistocles was chosen general by the Athenians. 5. Come, friend. 6. O dear friends, come hither.

VERBAL ADJ. ἰστέον

ITALIAN.—XVII

Irregular Verbs.—It should be noted that the stem of the Conditional is always like that of the Future; also, that by changing the ending **ti** of the second person singular Past Definite into **si** we obtain the first person singular of the Imperfect Subjunctive. These tenses, along with the Imperative (which was explained on p. 99), will not be given unless the above rule be broken. Any other tense not given is regularly formed.

First Conjugation

Andare, *to go*

Pres. Indic.: vado (*or* vo), vái, va, andiamo, andate, vanno.
Future: andrò, etc.
Imperative: va', vada, andiamo, andate, vádano.
Pres. Subj.: vada, vada, vada, andiamo, andiate, vádano.

Dare, *to give*

Pres. Indic.: do, dái, dà, diamo, date, danno.
Past Def.: diedi (*or* detti), desti, diede (*or* dette), demmo, deste, diédero (déttero).
Future: darò, etc.
Imperative: da', día, diamo, date, díano (*or* díeno).
Pres. Subj.: día, día, día, diamo, diate, diano (*or* díeno).

Fare (from fácere), *to do, make;* facendo, fatto

Pres. Indic.: fo (*or* faccio), fái, fa, facciamo, fate, fanno.
Imperfect: faceva, facevi, faceva, facevamo, facevate, facévano.
Past Def.: feci, facesti, fece, facemmo, faceste, fécero.
Future: farò, etc.
Imperative: fa', faccia, facciamo, fate, fácciano.
Pres. Subj.: faccia, faccia, faccia, facciamo, facciate, fácciano.

Conjugate similarly **soddisfare**, *to satisfy.*

Stare, *to stand*

Pres. Indic.: sto, stái, sta, stiamo, state, stanno.
Past Def.: stetti, stesti, stette, stemmo, steste, stéttero.
Future: starò, etc.
Imperative: sta', stía, stiamo, state, stíano (*or* stíeno).
Pres. Subj.: stía, stía, stía, stiamo, stiate, stiano (*or* stíeno).

Second Conjugation

Cadere, *to fall*

Past Def.: caddi, cadesti, cadde, cademmo, cadeste, cáddero.
Future: cadrò, etc.

Conjugate similarly **scadere**, *to fall due.*

Dissuadere, *to dissuade. Past part.*, dissuaso

Past Def.: dissuasi, dissuadesti, dissuase, dissuademmo, dissuadeste, dissuásero.

Conjugate similarly **persuadere**, *to persuade.*

Dolere, *to pain, to ache;* **dolersi**, *to complain, grieve*

Pres. Indic.: dolgo, duoli, duole, dogliamo (*or* dolghiamo), dolete, dólgono.
Past Def.: dolsi, dolesti, dolse, dolemmo, doleste, dólsero.
Future: dorrò, etc.
Pres. Subj.: dolga, dolga, dolga, dogliamo, dogliate, dólgano.

Dovere, *to owe, be obliged, must*

Pres. Indic.: devo (debbo), devi, deve (debbe), dobbiamo, dovete, dévono (débbono).
Past Def.: dovéi (dovetti), dovesti, dovè (dovette), dovemmo, doveste, dovérono (dovéttero).
Future: dovrò, etc.
Pres. Subj.: debba, debba, debba, dobbiamo, dobbiate, débbano.

Parere, *to appear, to seem. Past part.*, parso (*or* paruto)

Pres. Indic.: paio, pari, pare, paiámo, parete, páiono.
Past Def.: parvi (parsi), paresti, parve (parse), paremmo, pareste, párvero (párs ero).
Future: parrò, etc.
Pres. Subj.: páia, páia, páia, paiámo, paiáte, páiano.

Potere, *to be able*

Pres. Indic.: posso, puói, può, possiamo, potete, póssono.
Past Def.: potéi (potetti), potesti, potè (potette), potemmo, poteste, potérono (potéttero).
Future: potrò, etc.
Imperative: None.
Pres. Subj.: possa, possa, possa, possiamo, possiate, póssano.

Rimanere, *to remain. Past part.*, rimasto (*or* rimaso)

Pres. Indic.: rimango, rimani, rimane, rimaniamo (rimanghiamo), rimanete, rimángono.
Past Def.: rimasi, rimanesti, rimase, rimanemmo, rimaneste, rimásero.
Future: rimarrò, etc.
Pres. Subj.: rimanga, rimanga, rimanga, rimaniamo (rimanghiamo), rimaniate, rimángano.

Sapere, *to know, to know how to* (French *Savoir*)

Pres. Indic. : so, sai, sa, sappiamo, sapete, sanno.
Past Def. : seppi, sapesti, seppe, sapemmo, sapeste, séppero.
Future : saprò, etc.
Imperative : sappi, sappia, sappiamo, sappiate, sáppiano.
Pres. Subj. : sappia, sappia (sappi), sappia, sappiamo, sappiate, sáppiano.

Sedere, *to sit*

Pres. Indic. : siedo (seggo), siedi, siede (sede), sediamo (seggiamo), sedete, siédono (séggono).
Past Def. : sedéi (sedetti), sedesti, sedè (sedette), sedemmo, sedeste, sedérono (sedéttero).
Future : sedrò, etc.
Pres. Subj. : sieda (segga), sieda (segga), sieda (segga), sediamo, sediate, siédano (séggano).

Conjugate similarly **possedere**, *to possess*, and other derivatives.

Tacere, *to be silent. Past part.*, taciuto

Pres. Indic. : taccio, taci, tace, tacciamo, tacete, tácciono.
Past Def. : tacqui, tacesti, tacque, tacemmo, taceste, tácquero.
Pres. Subj. : taccia, taccia, taccia, tacciamo, tacciate, tácciano.

This verb is sometimes spelt with only one **c** where the double **c** is given here, in order to distinguish it from **tacciare**, *to accuse*.

Tenere, *to keep, hold*

Pres. Indic. : tengo, tieni, tiene, teniamo, tenete, téngono.
Past Def. : tenni, tenesti, tenne, tenemmo, teneste, ténnero.
Future : terrò, etc.
Pres. Subj. : tenga, tenga, tenga, teniamo, teniate, téngano.

Conjugate similarly the derivatives of **tenere**.

Valere, *to be worth. Past part.*, valuto (*or* valso)

Pres. Indic. : valgo, vali, vale, valiamo (valghiamo), valete, válgono.
Past Def. : valsi, valesti, valse, valemmo, valeste, válsero.
Future : varrò, etc.
Pres. Subj. : valga, valga, valga, valghiamo, valiate (valghiate), válgano.

Conjugate similarly **equivalere**, *to be equivalent, to equal*; **prevalere**, *to prevail*.

VOCABULARY

il rialzo, *rise*.
la moneta, *money, coin*.
l'occhiata (f.), *glance*.
il nastro, *ribbon*.
chiuso, *up to, closed*.
la novità, *novelty*.
l'attrattiva (f.), *attraction, inducement*.
la scala, *stairs, staircase*.
il piróscafo, *steamer*.
il fastidio, *trouble*.
conchiúdere, *to conclude, effect, do*.
il ramo, *branch, line*.
pareggiare, *to settle, to match*.
ribassare, *to fall*.
la prova, *proof, trial*.
carta bianca, *complete liberty, carte blanche*.
appena, *hardly, as soon as, scarcely*.
il dipartimento, *department*.
la pendenza, *debt*.
senz'altro, *immediately, at once*.
rípido, *steep*.

Exercise 33

Translate into English :—

1. Il rialzo nel cambio mi diede l'occasione di fare buoníssimi affari coll'éstero. 2. Le esportazioni stéttero ieri al medésimo livello. 3. Domani vado a Parigi e Roma. 4. Quando andrete a Torino? 5. Si fece dare delle monete d'oro. 6. I clienti diédero un'occhiata ai nastri. 7. Il prezzo ribasserà certamente fra poco. 8. Cáddero sulla (dalla) scala e si fécero male. 9. I prezzi di tutte le merci hanno subito un ribasso. 10. Faremo imbarcare i colli sul próssimo piróscafo.

Exercise 34

Translate into Italian :—

1. We shall go to Milan shortly. 2. The rise in the exchange will give us an opportunity to do better business abroad. 3. I must ask them to give me a guarantee for the amount of the order. 4. When do they go to Leghorn? 5. They got them to give them the bill of lading and the invoice. 6. We gave them a lot of trouble, it is true, but we asked them to excuse us for doing so. 7. As soon as the packages arrived, I made you a remittance of the corresponding amount. 8. The price fell so much that it did not appear possible to sell the goods. 9. I gave a glance at the novelties, but I bought nothing of them. 10. I am sorry that his offers have no special inducement for me.

Key to Exercise 30

1. Speriamo che i vostri amici ábbiano a trovare prezzi e condizioni di tutta loro convenienza e che senz'altro ci favoríscano del loro ambito órdine. 2. Da parte nostra vi assicuriamo (che) abbiamo fatto quanto ci era possibile. 3. Quanti capítoli avete letti, trenta o trentuno? 4. Speriamo avere il piacere di incominciare con v/. gradito mezzo di fare qualche affare. 5. Egli si riferisce alla súa léttera dell'otto andante, che compiega fattura di un nuovo órdine, nonchè uno cheque a pareggio (saldo) del (*or*: per saldare il) súo conto. 6. Non avete poi a dubitare che forniremo mácchine che non lasciaranno per nulla a desiderare sotto ogni rapporto.

Key to Exercise 31

1. The prices indicated to you then (argumentatively), in view of the instability of the metal market, are not really fixed (binding). 2. In the year 1918 the War ended. 3. On account of the continual fluctuations of the exchange, the prices may suffer some slight variation. 4. 3,101 or 3,108 bales of wool have arrived. 5. If during the construction we have considerable increases or decreases, either in the raw materials or in the workers, prices will go up. 6. The second month of the year is February. 7. We have shown all the plant needed for a production of slippers. 8. We begin to work on Monday and end on Saturday. 9. You may therefore choose those machines which may interest you and which you do not yet possess. 10. What time is it? A. C.

SPANISH.—XVIII

Irregular Verbs.—The principal irregularities have already been given, but it will be useful now to arrange their regular verbs of the three conjugations. The tenses, which the student can easily supply himself, such as the **Conditional Subjunctive,** formed from the Future Indicative, the **Present Subjunctive,** formed from the 1st person of Present Indicative, also the **Imperfect Subjunctive, Future Subjunctive,** and **Conditional Subjunctive** will be omitted. These three tenses are invariably formed from the 3rd person plural of the Past Definite Indicative. Only the 1st person of the Future Indicative will be given, and the 2nd singular of the Affirmative Imperative where necessary.

Of the First Conjugation we give three verbs :—

Andar, *to go, to walk.*

Past Def. : anduve, anduviste, anduvo, anduvidos, anduvisteis, anduvieron.

Dar, *to give.*

Pres. Ind. : doy, das, etc.
Pres. Subj. : dé, des, dé, etc.
Past Def. : di, diste, dió, dimos, disteis, dieron.

(Conjugate similarly **desandar,** *to go back, to undo.*)

Jugar, *to play.*

Pres. Ind. : juego, juegas, juega, jugamos, jugáis, juegan.

This verb is modified in a similar manner to **acordar**, i.e. the stem vowel, in this case **u**, is changed into **ue**, where the **o** of **acordar** (Lesson XI.) changes into **ue**.

In the Second Conjugation the following verbs should be noted :—

Caber, *to be contained,* or *containable, to find room.*

Pres. Ind. : quepo, cabes, etc. (rest of persons regular).
Past Def. : cupe, cupiste, cupo, cupimos, cupisteis, cupieron.
Future : cabré, etc.

Caer, *to fall.*

Pres. Ind. : caigo, caes, cae, caemos, caéis, caen.

Conocer, *to know* (French *connaître*).

Pres. Ind. : conozco, conoces, etc.

(Conjugate similarly all verbs ending in **acer**, **ecer**, or **ocer**, as also the verb **lucir**, *to shine*, except **hacer**, **mecer**, **cocer**, and their compounds. **Mecer**, *to stir*, **cocer**, *to cook*, are regular, but **cocer** changes the **o** into **ue** in the same cases as **acordar** ; **hacer** is conjugated below.)

Hacer, *to make, do* (*gerund,* **haciendo** ; *past part.,* **hecho**).

Pres. Ind. : hago, haces, etc.
Past Def. : hice, hiciste, hizo, hicimos, hicisteis, hicieron.
Future : haré, etc.
Imperative : ¡ haz, (tu) !

(As mentioned in Lesson VII., the 2nd person singular of the Affirmative Imperative is formed from the corresponding person of the present indicative by dropping the final **s** of latter ; only the irregularities are given in these tables.)

Conjugate similarly : **contrahacer**, *to counterfeit ;* **deshacer**, *to undo ;* **satisfacer**, *to satisfy ;* **rehacer**, *to do again.*

Perder, *to lose.*

Pres. Ind. : pierdo, pierdes, pierde, perdemos, perdéis, pierden.
Pres. Subj. : pierda, pierdas, pierda, perdamos, perdáis, pierdan.

(This verb is like **pensar**, given in Lesson XI. Conjugate similarly : **ascender**, *to ascend ;* **atender**, *to attend ;* **cerner**, *to sift ;* **contender**, *to contend ;* **defender**, *to defend ;* **descender**, *to descend ;* **encender**, *to light ;* **entender**, *to understand ;* **extender**, *to extend ;* **heder**, *to stink ;* **hender**, *to cleave ;* **reverter**, *to overflow ;* **tender**, *to stretch ;* **transcender**, *to transcend ;* **verter**, *to spill.*)

Poder, *to be able* (can, could) ; pudiendo, podido.

Pres. Ind. : puedo, puedes, puede, podemos, podéis, pueden.
Pres. Subj. : pueda, puedas, pueda, podamos, podáis, pueden.
Past Def. : pude, pudiste, pudo, pudimos, pudisteis, pudieron.
Future : podré, etc.

Poner, *to put ;* poniendo, puesto.

Pres. Ind. : pongo, pones, etc.
Past Def. : puse, pusiste, puso, pusimos, pusisteis, pusieron.
Future : pondré, etc.
Imperative : ¡ pon (tú) !

(Conjugate similarly: **anteponer**, *to prefer, to place before ;* **componer**, *to compose ;* **contraponer**, *to oppose ;* **deponer**, *to depose,* **disponer**, *to dispose ;* **oponer**, *to oppose ;* **reponer**, *to replace ;* **suponer**, *to suppose.*)

Querer, *to wish, want, like.*

Pres. Ind. : quiero, quieres, quiere, queremos, queréis, quieren.
Pres. Subj. : quiera, quieras, quiera, queramos, queráis, quieran.
Past Def. : quise, quisiste, quiso, quisimos, quisisteis, quisieron.
Future : querré, etc.

(Conjugate compounds similarly : **bien-**

querer, *to wish good to ;* **malquerer**, *to abhor.*)

Saber, *to know, to know how to* (French *savoir*).

Pres. Ind. : sé, sabes, sabe, sabemos, sabéis, saben.
Pres. Subj. : sepa, sepas, sepa, sepamos, sepáis, sepan.
Past Def. : supe, supiste, supo, supimos, supisteis, supieron.
Future : sabré, etc.

(Conjugate similarly: **resaber**, *to know very well.*)

Traer, *to bring, carry ;* trayendo, traído.

Pres. Ind. : traigo, traes, etc.
Past Def. : traje, trajiste, trajo, trajimos, trajisteis, trajeron.

(Conjugate similarly: **atraer**, *to attract ;* **contraer**, *to contract ;* **distraer**, *to distract.*)

Valer, *to be worth.*

Pres. Ind. : valgo, vales, etc.
Future : valdré, etc.
Imperative : ¡ vale (tú) ! But sometimes val when joined to a pronoun, as valme or váleme, etc.

(Conjugate similarly: **equivaler**, *to be equal in value, to be equivalent ;* **prevalerse (de)**, *to avail one's self (of).*)

Ver, *to see ;* viendo, visto.

Pres. Ind. : veo, ves, etc.
Imperf. Ind. : veía, veías, etc.
Past Def. : ví, viste, vió, vimos, visteis, vieron.

(Conjugate similarly : **antever**, *to foresee ;* **entrever**, *to see imperfectly ;* **prever**, *to foresee ;* **rever**, *to review.*)

Volver, *to return ;* volviendo, vuelto.

(This **-uelto** ending only refers to verbs terminating in **-olver** ; other verbs of this class are regular in the past participle.)

Pres. Ind. : vuelvo, vuelves, vuelve, volvemos, volvéis, vuelven.
Pres. Subj. : vuelva, vuelvas, vuelva, volvamos, volváis, vuelvan.

(Conjugate similarly: **absolver**, *to absolve ;* **cocer**, *to cook ;* **disolver**, *to dissolve ;* **doler**, *to ache ;* **llover**, *to rain ;* **moler**, *to grind ;* **morder**, *to bite ;* **mover**, *to move ;* **oler**, *to smell ;* **resolver**, *to resolve ;* **soler**, *to be accustomed ;* **torcer**, *to twist.*)

VOCABULARY

amenudo, a menudo, *often.*
triste, *sad.*
ponerse, *to become.*
desempeñar, *to carry out, fulfil.*
la aceptación, *acceptance* (of a bill of exchange, etc.).
el sobre, *envelope.*
cubrirse, *to put one's hat on.*
ponerse bueno, *to get on in the world.*
vivir de sus rentas, *to live on one's income.*
dar un paseo, *to take a walk.*
convocar, *to convoke, call together, summon.*
bastar, *to suffice, be sufficient.*
la circular, *circular* (letter).
el dos por ciento, 2 *per cent.*
hacerse mal, *to hurt one's self.*
con el sombrero puesto, *with one's hat on.*
la reunión, *meeting.*
regularmente, *regularly.*
el café, *café.*
el restaurante, *restaurant.*
hacer oscuro, *to be dark.*
el gerente, *manager.*
el paño, (*woollen*) *cloth.*
plena autoridad, *full authority.*
plenos poderes, *full power.*
cualquier cosa, *whatever.*

Exercise 33

Translate into English :—

1. Veíamos al comprador cada día durante el mes de Agosto. 2. Esta calidad no valdrá la mitad del precio cotizado. 3. Hizo sus posibles, pero no lo pudo conseguir. 4. Le dí la letra para que la aceptase. 5. No juegan nunca cuando es la hora de trabajar. 6. Que caiga o que no caiga, no voy a confiarle más dinero. 7. Era entonces que íbamos amenudo a hacerles visita. 8. Sin que V. le conozca de vista es inútil que V. vaya a encontrarle. 9. Lo pusieron en la mesa y se marcharon. 10. Se pondrá muy triste si no hago lo que le prometí.

Exercise 34

Translate into Spanish :—

1. How many circulars found room (were contained) in the envelope ? 2. Supposing we gave you 2 per cent. discount, when would you bring the money ? 3. Do not fall ; you would do yourself harm (hurt yourself). 4. Before he comes, bring the whole collection of samples. 5. I beg of you to give me an idea how to begin this (so) difficult letter. 6. He came in with his hat on. 7. I told him to put his hat on. 8. Get on in the world, if you wish to live on your income. 9. For fear we should fall, we shall not take a walk to-day. 10. It was necessary that all the persons summoned to the meeting should be accommodated (get) in the room.

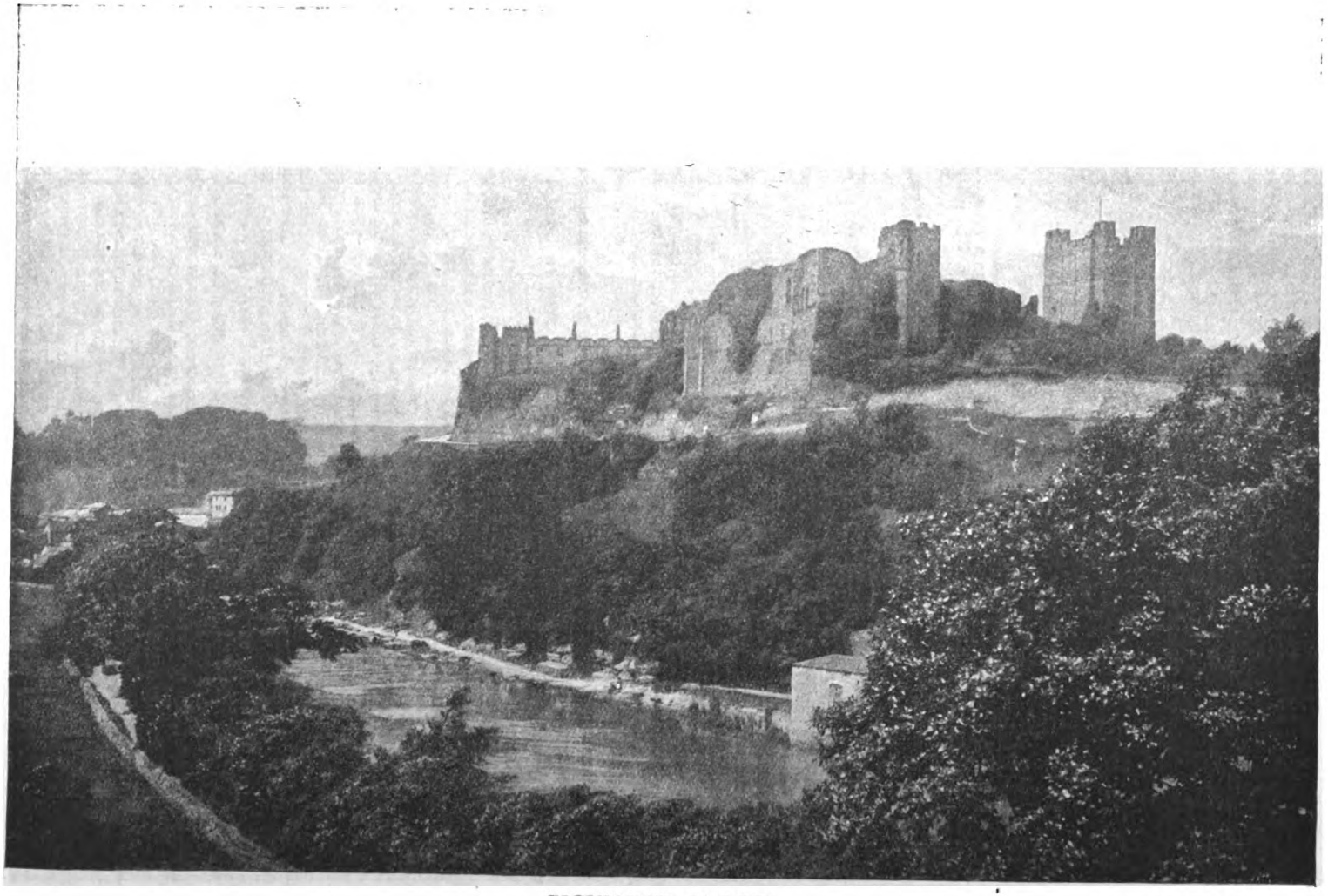
Key to Exercise 31

1. We shall have business relations with those very rich firms. 2. We have sent to-day twenty-one cases of umbrellas. 3. After having examined the little pattern which you sent us, we have decided to order from you seven or eight bales of this cloth. 4. The firm of Gonzalez and Son have always executed our orders most carefully. 5. Have the goodness to effect the sale of the goods with due regard to my best interests (to the best advantage). 6. We advise you to tell them (it) in a way that cannot give them offence (not likely to give offence). 7. There are a hundred persons in this room, I cannot get in (find room) here. So many people could not find space in the room last week. 8. I do not know why you become offended at anything I say.

Key to Exercise 32

1. Los lunes y los viernes recibimos consignaciones de paraguas. 2. Nuestros amigos, los Sres. Moreno e Hijos, no han ejecutado este pedido con su cuidado de costumbre (or, cuidado usual). 3. Nos aconsejaron que fuésemos (fuéramos) a Madrid antes que nuestro cliente saliera para Sud-América. 4. Todas estas piezas no cabrán en una sola caja. 5. Hice mis posibles para entregar los géneros en tiempo oportuno, pero no lo pude, por motivo de un incendio o de un accidente de alguna especie que tuvo lugar a (*or* en) la fabrica. 6. Si tienen buen éxito, harán sus posibles para aumentar (ensanchar) sus relaciones.

A. C.



RICHMOND CASTLE, *Photo: Frith and Co., Reigate.*

commanding the beautiful valley of the Swale, is one of Yorkshire's many historic castles. It was built in 1071.

Continued from page 298.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

THE BRITISH ISLES.—IV

GEOLOGICALLY the Pennines consist of a great arch of limestone of Carboniferous age from which the coal-measures, originally lying above it, have been washed away, leaving, however, several important coal-fields on its flanks; these, however, we shall discuss later. South of the Ribble valley for many miles the limestone is covered with the Millstone Grit, a series of hard sandstones. This sandstone formation forms heather-covered plateaux, whereas in the limestone districts are green covered slopes intersected by stone walls, and often having small perpendicular limestone cliffs on the sides of the hills. In the Peak district of Derbyshire where the Pennine Chain terminates are many extraordinary caverns worn in the limestone. In one of these it is possible to travel in a boat for half a mile, in a narrow canal, until the water pours over into a deep pool situated in a cavern nearly 500 feet in height. The caverns are adorned with stalactites and stalagmites which sometimes unite to form pillars of rock, draped with sheets of stalagmite, accumulated by the precipitation of lime from the water which continually drips over them.

Pennine Peaks

The Pennines contain peaks of over 2,000 feet high, such as Crossfell (2,930 feet), Whernside, Ingleboro', etc. Owing to their height the Pennines intercept the westerly winds as they cross the country, and the rain, being precipitated on the western side, leads to a remarkable difference in the dampness of the climate of the two sides. The rainfall in Bolton, on the west, for instance, is about twice as great as that in Leeds on the eastern side of the range.

For the most part the Pennines are used as sheep pastures, though in the valleys, where the chief part of the population is found, agriculture is carried on. Many of these valleys, especially those forming the Yorkshire Dales, such as Swaledale, Wensleydale, etc., are very picturesque, and the smaller valleys of Derbyshire like Dovedale, Miller's Dale, etc., are noted tourist resorts.

There are, as is natural, no large towns situated on these upland districts, and such small towns as exist are usually agricultural centres and market towns for the surrounding district.

A Great Coal-field

To the east of the Pennine Chain, at the extreme north of the country, we have the agricultural district of Northumberland, in which are situated the towns of Alnwick and Morpeth, both the centre of pretty scenery, and both the sites of castles of great importance in bygone times as guarding the level ground leading eastward of the Cheviots into Scotland. Alnwick Castle is of great size and is kept in perfect repair.

Further south we come to the great Northumberland and Durham coal-field, an important centre of the iron industry and especially connected with shipbuilding. The iron ore is brought from the adjacent Cleveland district in North Yorkshire, and the limestone used in smelting the ore is near-by, occupying a large area in both counties.

The ports along the lower Tyne, such as Newcastle, Gateshead, Jarrow and Shields; Sunderland, on the Wear; Middlesbrough, on the Tees, and Hartlepool, to the north of that river, are the chief centres of the ship-building industries, while Darlington, Stockton-on-Tees and Middlesbrough have great engineering works of various kinds.

The city of Newcastle is large and important, and owing to the large numbers of factories the district has mainly an industrial aspect. Durham, on the other hand, though of small size, possesses one of the most beautiful cathedrals in the British Isles, most picturesquely situated on the high banks of the Wear which are covered with trees; it also has an interesting castle, the seat of a university.

South of the Northumberland and Durham coal-field we reach the plain of Yorkshire, consisting largely of sands and gravels of recent age and very fertile. York is situated in the middle of the plain, an historic city still retaining much of its old walls and many ancient buildings, including the "bars" or gates of the city, and its magnificent Minster—the seat of an archbishopric. Other towns of the plain are Northallerton, Ripon, Doncaster, etc. Ripon has a small but beautiful cathedral, and near-by stand the ruins of Fountains Abbey amid exceedingly picturesque surroundings.

On the east of the plain are the moors of north Yorkshire separated from the wolds of the south by the fertile vale of Pickering, through which flows the river Derwent. The moors are but thinly populated except in the regions where the famous Cleveland ironstone is mined near to Middlesbrough. The scenery is very fine, especially along the coast, where are situated many watering places such as Whitby, with its ruined abbey on the cliff top, Scarborough, etc., with many villages. Jet is found and worked at and near Whitby, though the industry is not now so important as it was at one time.

The Wolds

The Wolds are chalky downs and extend out to sea in fine headlands such as Flamborough Head. The projection of Yorkshire that extends out to the north of the mouth of the Humber is known as Holderness; it is a low-lying land covered with glaciated gravels, clays, etc., and, as is usually the case with this formation, exceedingly fertile. Beverley and Hull are the most important towns in this district. Goole, farther up the river, is also a port with a considerable trade with European ports.

On the Pennine slopes of west Yorkshire is the Yorkshire coal-field, largely employed in the woollen and worsted industries, for the carrying on of which the coal is used as a fuel. The wool is now largely imported, though before the industry had grown to its present size the sheep were reared on the pastures, and the wool washed in the abundance of pure water derived from the springs and streams. Leeds is the centre of the manufacture of woollens, and other towns engaged in it are Huddersfield, Wakefield, etc. At Bradford worsteds are manufactured, and at Halifax carpets. Sheffield is the metropolis of the cutlery trade of Great Britain—one might almost say of the world. It has enormous steel works for all purposes, including the rolling of armour plate for warships. Near Rotherham the hard sandstones of the Carboniferous series are quarried for grindstones, and these have helped to establish the edge-tool and cutlery manufactures of Sheffield and the district.

The county of Yorkshire is divided for administrative purposes into three "Ridings," the North, East, and West. Historically it is one of the most interesting of the English counties, the city of York itself being at one time an important Roman station. Throughout the county there are remains of castles, once of great importance as points of vantage, commanding the routes over the hills, etc., such as Pontefract, Pickering, Richmond, Middleham, etc., and many abbeys and monasteries, the chief of which are, perhaps, Fountains, already mentioned, Rievaulx, Jervaulx, Bolton and Kirkstall.

Westmorland Lakes

On the west side of the Pennine Chain the county of Cumberland occupies the northern portion. In the extreme north and west the county borders on the Solway Firth and inland, as far as Carlisle, the county town, is level. Along the coast, extending south nearly as far as St. Bees Head, is the small Cumberland coal-field in which Whitehaven and Workington are the chief towns, and between Workington and Morecambe Bay in Lancashire, the rich iron ore known as Hæmatite is extensively worked in the Triassic series of rocks. The coal mines of the district are in some places actually worked far out under the sea. The south and east of the county are mountainous, and include the well-known Lake District, which extends also into Westmorland and North Lancashire. Here are found the highest mountains in England which culminate in Scafell, 3,210 feet high, Helvellyn, 3,118 feet and Skiddaw, 3,054 feet. The lakes, of which Windermere, ten miles long, is the largest, combined with the mountains, woods and waterfalls make the Lake District unsurpassed for scenery in England.

Sheep-farming is the chief industry, but at Keswick, deposits of graphite caused the inception of the manufacture of lead pencils, though the graphite for the purpose is to-day mostly imported. At Barrow, in the almost detached Furness district of Lancashire, are large docks and extensive iron and shipbuilding works.

The northern portion of the main part of Lancashire is agricultural and pastoral, but south of Preston we have the great manufacturing district situated on the Lancashire coal-fields. The enormous cotton industry

of this region has been rendered possible by the supply of coal, the facilities for importing raw material from the United States of America, and the dampness of the climate so necessary to prevent the breaking of the yarn.

The industry is centred round Manchester, which acts as a collecting and distributing base, and, since the construction of the Manchester Ship Canal, also as a port. The towns clustered around it are Bolton, Bury, Barnsley, Rochdale, Oldham, Stockport, (in Cheshire), and many of less size. Liverpool, the great port at the mouth of the Mersey, owes its importance to the industries in the region situated behind it, and to its magnificent docks.

Manchester Ship Canal

The Manchester Ship Canal connecting Liverpool with Manchester is 35 miles long, and will take vessels of all but the largest size. It was opened in 1894, and its construction has increased the trade of the port of Manchester nearly fourfold.

South of the Pennine Chain, with prolongations north-east along the valley of the Trent and north-west through Cheshire in the valleys of the Mersey and the Dee, stretches the great central or midland plain of England. On the west it is bounded by the Welsh hills; and the Jurassic escarpment formed by the Cotswold Hills, the uplands of Northamptonshire, and the "edge" of Oolite rocks that runs north and south through Lincolnshire, forms the southern and south-eastern boundary. With the exception of the coal-field of north and south Staffordshire, and the small coal-fields of Warwickshire and Leicestershire, the land forms a rich agricultural district of a rolling nature diversified by higher land in a few isolated spots, such as Charnwood Forest, the Malvern Hills, etc., where igneous rocks have been left bare. On the south of the plain is the fertile valley of the Avon joining the Severn at Tewkesbury, and it is this river that, perhaps, typifies best the character of the plain.

In the centre of the plain stands the city of Birmingham, and to the north of this the great manufacturing and colliery district known as the Black Country, extending for 12 or 14 miles in a continuous area of collieries, furnaces and factories, where are manufactured almost every kind of article that can be fabricated of metal. In Birmingham itself steam-engines, fire-arms, small metal goods and jewellery are made, among other things, and the city of nearly a million inhabitants is an important collecting and distributing centre for the whole district. Close by, at Redditch, are made needles and fish-hooks: at Bromsgrove, nails: at Kidderminster, carpets; and bricks of fire-clay at Stourbridge.

A little farther to the north is the pottery district of Staffordshire, where in a cluster of towns such as Stoke, Hanley, Burslem, etc., china, earthenware and coarse pottery is made. In the lower Trent valley are situated Burton, famous for its breweries; Nottingham employed largely in cotton hosiery and lace, and on the Soar, a tributary of the Trent, Leicester, the great woollen hosiery manufacturing centre.

Evesham's Prolific Orchards

In that portion of the Midland plain which runs through Cheshire we have the salt district of Nantwich, etc., but the greater part of the county is agricultural.

The more southern counties of the plain, Warwickshire, Worcestershire, part of Gloucestershire, and also Nottinghamshire and Leicestershire, are in the main likewise agricultural, especially fertile being the Vale of Evesham with its prolific orchards and market gardens.

Among the towns in the Avon valley we must mention Rugby, famed for its great school; Warwick, with its magnificent mediæval castle, still inhabited; Stratford-on-Avon, the birthplace of Shakespeare; Tewkesbury, possessing a beautiful abbey, and many others. At Coventry, only just outside the valley, we find another ancient town now noted chiefly for the manufacture of automobiles, though once the centre of the ribbon manufacturing industry.

In Nottinghamshire are the still considerable remains of Sherwood Forest, now a district containing so many large country seats that it is known as "The Dukeries."

The western border of the Midland plain fringes the Welsh mountains and is, both physically and historically, a separate district. The Welsh Marches, as this region may be called, is a belt of land stretching from the estuary of the Dee to that of the Severn, and comprises parts of the counties of Cheshire, Shropshire, Herefordshire and Monmouthshire. In order to protect it Roman, Norman, and later on the English built castles all along the line and made roads rendering communication easy between these fortified places. To this day the castles, mostly in ruins, stand as evidence of the turbulent times in our history. The most important of the castles were Chester,

Shrewsbury, Ludlow, and Chepstow, but there are many others of only less importance such as Raglan, Skenfrith, Clun, Whittington, etc. The country generally is hilly, and the industries are mainly agricultural.

The chief towns are Chester, still surrounded by its ancient walls, and distinguished by its quaint gabled houses fronted by galleries forming the "Rows," in which are situated the chief shops; Shrewsbury, in a loop of the Severn, with picturesque timbered houses along the streets rising up from the river, and containing the birthplace of Charles Darwin; Ludlow, climbing up the steep bank of the Teme and culminating in its majestic ruined castle, probably unrivalled for beauty of situation on its tree-covered rock; Monmouth, on the Monnow near its junction with the Wye; and Chepstow, at the mouth of the river.

The counties of Hereford, Worcester, Gloucester and Monmouth are famed for their orchards and hop-gardens, and embrace some of the most charming scenery in the country. Especially to be noted is the Wye valley between Ross and Chepstow, the river passing between high wooded banks assuming in many places the steepness of a cliff. Midway in the valley between Monmouth and Chepstow is the ruined abbey of Tintern, a centre of attraction to all lovers of the beautiful, standing on a narrow level tract at the edge of the river and embosomed between lofty wooded hills.

Fine cathedrals exist at Worcester, Gloucester and Hereford, and there is also one of lesser size at Chester. In Gloucestershire, on the north bank of the Severn, is the small coalfield of the Forest of Dean, situated in one of the most extensive remains of the old forests that once covered the country.

The whole of the east coast of England south of the Lincolnshire Wolds is flat, much of it in the basins of the rivers draining into the Wash being fenland, though now well drained. There are no large towns, the most important being the agricultural and pastoral centres. Lincoln possesses one of the finest of the English cathedrals; Cambridge is the seat of one of the two mediæval universities; Ely, near-by, is but a small town with another fine cathedral. Norfolk, besides its county town of Norwich, which is another cathedral city, possesses in the port of Yarmouth a town noted for the curing of herrings known as "bloaters." Harwich, in Essex, is an important port for steamers serving the Belgian and Dutch coasts. In Bedfordshire is Luton, where the straw-plait industry is followed; at Northampton boots and shoes are manufactured. C. J. S.

From the picture by E. Bundy, A.R.A.

THE HERRING SEASON AT YARMOUTH,

the East Coast port, noted for the curing of herrings, which are then known as bloaters.

Continued from page 304.

MATHEMATICS:

Contributor: — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.

(M. A. Lewenz, M.A.[Lond.]).

HYDROSTATICS.—III

21. **The hydrostatic balance.**—This is a balance adapted for weighing bodies suspended in a fluid.

By means of this balance we may verify the principle of Archimedes experimentally. Take two brass cylinders A and B, such that A is solid and exactly fits into B, which is hollow. Suspend them from one pan of the balance, the hollow one uppermost, and weigh them accurately.

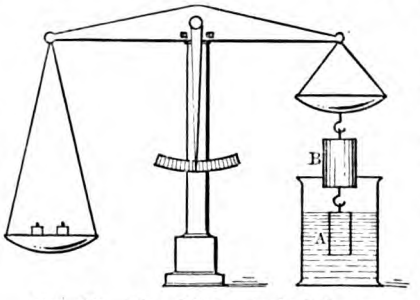


Fig. 17.—The Hydrostatic Balance.

Next place a vessel with water so that the solid cylinder is just immersed, and note the weight in this case. The total weight of the cylinders will be found to be considerably less than before.

Lastly, fill the upper cylinder with water, letting the solid one remain immersed. It will be found that the total weight is the same as before the solid cylinder was immersed.

Since the lower cylinder exactly fits into the upper, the volume of water in the upper cylinder exactly equals the volume of the lower cylinder. Consequently the apparent loss of weight, due to the upward pressure of the water, is exactly equal to the weight of an equal volume of water, i.e. of the water displaced.

22. **Density and specific gravity.**—We know that the same volumes of different bodies do not have the same weight. For instance, a block of wood will float only partially immersed in water, and we know that the weight of the volume of water displaced equals the weight of the whole block of wood, i.e. bulk for bulk, water is heavier than wood. This we express by saying that the *mass* of a given volume of water is greater than the *mass* of the same volume of wood, or, in other words, that the **density** of water is greater than that of wood.

We may define the **density** of a substance as the mass per unit volume of that substance. Thus, if d be the density of a substance, M its mass, and V its volume, we have $M = Vd$ or $d = \frac{M}{V}$.

If we take as unit of weight the weight of the unit of mass, the weight of unit volume of a substance will be numerically the same as its density.

If we take as unit of weight the poundal or dyne, the relation between weight and mass is $W = Mg$, and hence the weight (w) of unit volume will be connected with the density d by the equation $w = gd$.

In the F. P. S. system the weight of water per unit volume is given by weight per cubic foot = 1000 oz. wt. = $62\frac{1}{2}$ lb. wt. = $62\frac{1}{2} \times 32$ poundals = 2000 poundals.

In the C. G. S. system weight per cubic centimetre = 1 gram wt. = 981 dynes.*

The **specific gravity** of a substance is the ratio of the weight of any given volume of that substance to the weight of the same volume of water.

Hence

specific gravity = s

$$= \frac{\text{weight of any volume of substance}}{\text{weight of equal volume of water}}.$$

If W′, M′ = weight and mass respectively of given volume of substance,

W, M = weight and mass respectively of equal volume of water,

w', m' = weight and mass respectively of unit volume of substance,

w, m = weight and mass respectively of unit volume of water,

d', d = densities of substance and water respectively,

then S, the specific gravity of the substance,

$$= \frac{W'}{W} = \frac{M'}{M} = \frac{w'}{w} = \frac{m'}{m} = \frac{d'}{d}.$$

Hence $d' = s \times d$ and $W' = s \times W$.

The specific gravity of some standard substance, usually water, is taken as unity.

23. **Examples :—**

(1) Find the weight of a cubic foot of steel. (Specific gravity of steel = 7·82.)

w = weight of 1 cb. ft. of water = 1000 oz.

---

* The temperature of the water is assumed to be 4° Centigrade.

$\therefore$ w' = weight of 1 cb. ft. of steel
= 1000 × 7·82 oz.
= 7820 oz.

(2) Find the weight of mercury required to fill a vessel 5 cm. long, 4 cm. broad and 2 cm. deep. (Specific gravity of mercury = 13·6.)

Vol. of vessel to be filled = 5 × 4 × 2 cb. cm. = 40 cb. cm.

$\therefore$ W′ = required weight of mercury
= 13·6 × W,
where W = weight of 40 cb. cm. of water.
$\therefore$ W′ = 13·6 × 40 gms. = 544 gms.

24. *To find the specific gravity of a mixture of substances whose volumes and specific gravities* are *given.*

Let v_1, v_2, v_3 . . . be the volumes of the substances.

Let s_1, s_2, s_3 . . . be the specific gravities of the substances.

V be the volume of the mixture.

S be the required specific gravity.

w be the weight of unit volume of water.

The weights of the given substances are given by $w_1 = v \times s_1$, $w_2 = v_2 \times s_2$, etc.

The weight of the mixture
= W = $w_1 + w_2 + w_3 + \ldots\ldots$
Now W = V × S.
$\therefore$ V × S = $v_1s_1 + v_2s_2 + v_3s_3 + \ldots\ldots$
Also V = $v_1 + v_2 + v_3 + \ldots\ldots$

$$\therefore \text{S} = \frac{v_1s_1 + v_2s_2 + v_3s_3 + \ldots\ldots}{v_1 + v_2 + v_3 + \ldots\ldots} \quad \text{(i).}$$

Similarly, if D be the density of the mixture and d_1, d_2, d_3 . . . . . the densities of the substances.

$$\text{D} = \frac{v_1d_1 + v_2d_2 + v_3d_3 + \ldots\ldots}{v_1 + v_2 + v_3 + \ldots\ldots} \quad \text{(ii).}$$

Often when substances are mixed contraction takes place, and in that case V = r ($v_1 + v_2 + v_3 + \ldots$), where r = some positive proper fraction. In this case the denominators in (i) and (ii) become r ($v_1 + v_2 + v_3 + \ldots$).

25. *To find the specific gravity of a mixture of substances whose weights and specific gravities are given.*

Let w_1, w_2, w_3 . . . be the weights of the substances.

Let s_1, s_2, s_3 . . . be their specific gravities.

If W = weight of mixture and S required specific gravity, since W = V S where V is the volume of the mixture, we have

$$\frac{\text{W}}{\text{S}} = \frac{w_1}{s_1} + \frac{w_2}{s_2} + \frac{w_3}{s_3} + \ldots\ldots$$

$$\therefore \text{S} = \frac{w_1 + w_2 + w_3 + \ldots\ldots}{\frac{w_1}{s_1} + \frac{w_2}{s_2} + \frac{w_3}{s_3} + \ldots\ldots}$$

If, however, contraction takes place

$$\text{V} = r\left(\frac{w_1}{s_1} + \frac{w_2}{s_2} + \frac{w_3}{s_3} + \ldots\ldots\right)$$

Where r is a positive proper fraction, and hence

$$\text{S} = \frac{w_1 + w_2 + w_3 + \ldots}{r\left(\frac{w_1}{s_1} + \frac{w_2}{s_2} + \frac{w_3}{s_3} + \ldots\right)}$$

26. **Examples :—**

(1) A pint of brandy, specific gravity ·84, is mixed with a quart of water (specific gravity 1). Find the specific gravity of the mixture.

$$\text{Specific gravity S} = \frac{v_1s_1 + v_2s_2}{v_1 + v_2}$$

$$= \frac{1 \times \cdot84 + 2 \times 1}{1 + 2} = \frac{2\cdot84}{3} = 946\dot{}.$$

(2) If equal volumes of two liquids be mixed, the sp. gr. of the mixture is 1·25; if equal weights of them be mixed, the sp. gr. is ·8. Find the sp. gr. of the two substances.

Let s_1 and s_2 be the required sp. grs.

In the first case

$$\text{S} = \frac{v_1s_1 + v_1s_2}{v_1 + v_1} \therefore 1\cdot25 = \frac{s_1 + s_2}{2}$$

$\therefore$ $s_1 + s_2 = 2\cdot5$ (i).

In the second

$$\text{S} = \frac{w_1 + w_1}{\frac{w_1}{s_1} + \frac{w_1}{s_2}} \therefore \cdot8 = \frac{2s_1s_2}{s_1 + s_2}$$

$\therefore$ ·4 ($s_1 + s_2$) = s_1s_2 (ii).

From (i) and (ii)

·4 × 2·5 = s_1 (2·5 − s_1).

$\therefore$ $s_1^2 - 2\cdot5s_1 + 1 = 0$.

$\therefore$ (s_1 − ·5) (s_1 − 2) = 0.

Hence s_1 = ·5 or 2 and s_2 = 2 or ·5.

i.e. the sp. gr. of the two substances are 2 and ·5.

Exercise 4

(1) A cubical block of wood floats in water with the top and bottom faces horizontal. The edge of the block is 8 inches, and one inch protrudes above the water. Find the sp. gr. of the wood.

(2) What is the specific gravity of a cubical block of edge 1 foot, if it just floats in water when attached to 2 cubic feet of cork, sp. gr. ·2 ?

(3) An alloy is made of silver and copper. The specific gravity of silver is 10·5, that of copper is 8·7. The specific gravity of the alloy is 10·14. Determine the relative amount of the two metals in the alloy by volume and weight.

(4) A mixture is to be made by mixing a parts by weight of one substance with b parts by weight of another; by mistake a parts by volume of the one are mixed with b parts by volume of the other. Show that the specific gravity of the mixture is greater than it would have been if the proper amounts of the substances had been taken.

(5) 1000 cb. cm. of a gas whose density is 10 are mixed with 2000 cb. cm. of a gas whose density is 14, and the volume of the mixture is diminished by one-sixth. What is the density of the mixture ?

27. **Determination of specific gravities.**—To find the specific gravity of a substance, we must know its real weight and its volume.*

* Since the air itself has weight, the apparent weight of a body is equal to its real weight diminished by the weight of the volume of air it displaces. To obtain the real weight of a body we must weigh it in a chamber from which the air has been pumped. Such a chamber is called a *vacuum*, and the real weight of a body is its weight *in vacuo*. For small solids the difference between the real weight and the apparent weight in air is so small as to be negligible as a rule.

The specific gravity of a solid may be found by first weighing in the air and then in water. If W = weight in air and W′ = weight in water, then W − W′ = weight of water displaced, and hence the specific gravity $= \frac{W}{W - W'}$.

This method may be used for solids insoluble in water.

If the solid floats in water, let W = weight of body in air, P the additional weight required to immerse it in water. Then W + P = weight of water displaced when the body is totally immersed, and hence the specific gravity $= \frac{W}{W + P}$.

If the solid be soluble in water but insoluble in another liquid of known specific gravity s, let W be the weight of the body in air and W′ its weight in the liquid, then W − W′ = weight of liquid displaced, and $\frac{W - W'}{s}$ = volume of liquid displaced. Hence $\frac{W - W'}{s}$ = weight of an equal volume of water, since the specific gravity of water = 1. Hence the required specific gravity $= \frac{W}{\frac{W - W'}{s}}$

$= \frac{Ws}{W - W'}$.

The specific gravity of a liquid may be found by weighing a solid in it. Let W = weight of solid in air, and W′ its weight in the given liquid, and W″ its weight in water. Then W − W″ = weight of water displaced, and W − W′ = weight of liquid displaced. Hence the specific gravity of the liquid $= \frac{W - W'}{W - W''}$.

28. Often specific gravity is determined by using a **specific gravity bottle.** This is a bottle made to hold a certain weight of water at 4° Centigrade. It is used in the following manner:

(1) *To find the specific gravity of a liquid.*

Let the weight of the bottle when empty = w.

Let the weight of water contained by the bottle = W.

Then the weight of the bottle full of water = w + W.

Now fill the bottle with the given liquid, and weigh as before. Suppose the weight to be W′. Then the weight of the liquid = W′ − w, hence the specific gravity of the liquid $= \frac{W' - w}{W}$.

(ii) *To find the specific gravity of a powder.*

Let W = weight of water contained by bottle.

Let W′ = weight of powder.

Place the powder in the bottle and then fill with water.

Let W″ be the weight of the powder and water together.

Then if X = weight of water displaced by the powder,

W″ = W + W′ − X ∴ X = W + W′ − W″,

Hence specific gravity $= \frac{W'}{W + W' - W''}$.

29. **Hydrometers.**—An hydrometer consists essentially of a stem loaded at one end so that it floats upright. By observing the depth to which it sinks in different liquids, the relative weights and hence the specific gravities of the liquids may be determined.

The common hydrometer.—This consists of a graduated glass stem blown out into two bulbs. The lower bulb is loaded with mercury so that when placed in a liquid the hydrometer floats upright.

Let a = section of the area of the stem.

Let w = weight of hydrometer.

Let v = volume of hydrometer.

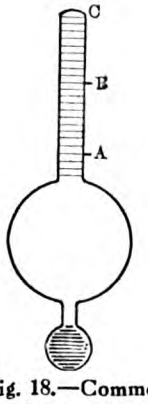


Fig. 18.—Common Hydrometer.

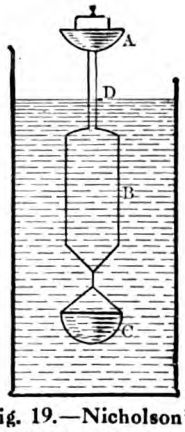


Fig. 19.—Nicholson's Hydrometer.

Suppose the instrument floats in water so that the point A is at the surface. Next place the hydrometer in the liquid whose specific gravity is to be found. Suppose the point B is now on the surface. Then if s = specific gravity of the liquid, by the principle of Archimedes we have

$w = s\,(v - a \times \text{C B}) = v - a \times \text{C A}$.

Hence $s = \frac{v - a \times \text{C A}}{v - a \times \text{C B}}$.

Nicholson's hydrometer.—This enables us to determine the specific gravity of solids as well as of liquids. It consists essentially of a hollow metal vessel B connected by a fine stem with a cup or scale pan A at its upper end, and carrying another cup or scale pan C at its lower end. A weight P placed in the upper pan is sufficient to sink the instrument in water so that the fixed mark D is on the surface.

(1) To find the specific gravity of a given liquid place sufficient weights in A to sink the instrument so that D is at the surface of the liquid.

If W = weight of instrument,

P = weight required to sink it to D in water,

w = weight required to sink it to D in given liquid,

then W + P = weight of water displaced,

and W + w = weight of liquid displaced.

And since volume displaced in each case is the same, the required specific gravity $= \frac{W + w}{W + P}$.

(2) To find the specific gravity of a solid place a small quantity of the solid on A, and removing P place a weight w in A so that the instrument when placed in water sinks to D. Then the weight of the body placed in the pan = P — w.

Next place the small quantity of the solid in C, and removing w place a weight w' in A so that the instrument again sinks to D. Then $w' - w$ = weight of water displaced by the solid, hence the specific gravity of the solid $= \frac{P - w}{w' - w}$.

Exercise 5

(1) A Nicholson's hydrometer of weight 5 oz. requires a weight of 2 oz. to sink it to the fixed mark in water. What weight will be required to sink it to the fixed mark in a fluid of density 2·5 ?

(2) A solid is placed in the upper cup of a Nicholson's hydrometer and it is found that 3 oz. is required to sink the instrument to the fixed mark. When the solid is in the lower cup 5 oz. are required, and when the solid is removed 9 oz. are required. What is the sp. gr. of the solid ?

(3) The stem of a common hydrometer is divided into 100 equal parts. It reads 0 in water and 100 in liquid of specific gravity ·8. What will it read in a liquid of sp. gr. ·85 ?

Key to Exercise 2

(1) 1000 gms. (2) 136000 gms. on base; 6800 gms. on each side. (3) 6120 gms. on top face 7820 gms. on bottom face; 6970 gms. on side faces.

Key to Exercise 3

(1) Each side measures 2·88 in. (2) 2094·4 lb.

M. A. L.

CO-ORDINATE GEOMETRY.—V

The Circle (*continued*).

44. *To find the co-ordinates of the points in which a given straight line cuts a given circle.*

Let the equation of the circle be $x^2 + y^2 = r^2$ (i).

Let the equation of the straight line be $y = mx + c$ (ii).

At the points where the straight line cuts the circle both (i) and (ii) are satisfied.

From (i) $y^2 = r^2 - x^2$.

From (ii) $y^2 = (mx + c)^2$.

Hence $r^2 - x^2 = (mx + c)^2$ or $x^2 (m^2 + 1) + 2cmx + c^2 - r^2 = 0$,

whence

$$x = -cm \pm \sqrt{c^2m^2 - (m^2 + 1)(c^2 - r^2)}.$$

If $c^2m^2 - (m^2 + 1)(c^2 - r^2)$ is positive, this gives two values of x, as we should expect.

If $c^2m^2 = (m^2 + 1)(c^2 - r^2)$, the two points in which the line cuts the circle are coincident, i.e. the line **touches** the circle.

If $c^2m^2 - (m^2 + 1)(c^2 - r^2)$ is negative, the line cuts the circle in two imaginary points.

Consider the case in which the line is a tangent to the circle, i.e. when $c^2m^2 = (m^2 + 1)(c^2 - r^2)$, or $c^2 = r^2(m^2 + 1)$, or $c = \pm r\sqrt{1 + m^2}$.

Then the lines $y = mx \pm r\sqrt{1 + m^2}$ touch the circle $x^2 + y^2 = r^2$, i.e. for every value of m there are two tangents parallel to any given straight line.

45. *To find the equation of a tangent at any point x', y' on the circle $x^2 + y^2 = r^2$.*

Let x'', y'' be any other point on the circle.

Then the equation of the chord through (x', y') and (x'', y'') is $\frac{x - x'}{x' - x''} = \frac{y - y'}{y' - y''}$ (i).

But since the two points are on the circle,

$x'^2 + y'^2 = r^2$, and $x''^2 + y''^2 = r^2$,

$\therefore x'^2 - x''^2 = -(y'^2 - y''^2)$ (ii).

Multiplying corresponding sides of (i) and (ii) we have

$(x - x')(x' + x'') = -(y - y')(y' + y'')$ (iii).

Now in the limit, when (x'', y'') moves up to (x', y') and ultimately coincides with it, the chord becomes the tangent. Hence, putting $x' = x''$ and $y' = y''$ in equation (iii), we get the equation of the tangent at the point (x', y'), viz. :

$(x - x')x' + (y - y')y' = 0$

or $xx' + yy' = x'^2 + y'^2$

i.e. xx' and $yy' = r^2$.

46. The same method may be used to find the equation of the tangent to the circle

$x^2 + y^2 + 2gx + 2fy + c = 0$.

As before, we have for the equation of the chord through (x', y') and (x'', y'')

$$\frac{x - x'}{x' - x''} = \frac{y - y'}{y' - y''} \quad \text{(i)}.$$

The points are both on the circle,

$\therefore x'^2 + y'^2 + 2gx' + 2fy' + c = 0$

and $x''^2 + y''^2 + 2gx'' + 2fy'' + c = 0$.

$\therefore (x' - x'')(x' + x'' + 2g)$

$= -(y' - y'')(y' + y'' + 2f)$ (ii).

Multiplying corresponding sides of (i) and (ii), we have

$(x - x')(x' + x'' + 2g)$

$= -(y - y'(y' + y'' + 2f)$.

Whence the equation of the tangent is

$(x - x')(x' + g) + (y - y')(y' + f) = 0$

or $xx' + yy' + gx + fy$

$= x'^2 + y'^2 + gx' + fy'$.

To each side add $gx' + fy' + c$, then

$xx' + y'y' + g(x + x') + f(y + y') + c = x'^2 + y'^2 + 2gx' + 2fy' + c = 0$.

47. *To draw a tangent to a circle from any point.*

Let $x^2 + y^2 = r^2$ be the equation of the circle, let $(x'y')$ be the given point, and $(x''y'')$ the point at which the tangent touches the circle.

Then the equation of the tangent is

$xx'' + yy'' = r^2$ (i).

And since (x', y') is a point on this line,

$x'x'' + y'y'' = r^2$ (ii).

From (i) and (ii)

$$x'' = \frac{r^2x' \pm ry'\sqrt{(x'^2 + y'^2 - r^2)}}{x'^2 + y'^2},$$

$$y'' = \frac{r^2y' \mp rx'\sqrt{(x'^2 + y'^2 - r^2)}}{x'^2 + y'^2}.$$

Hence from any point (x', y') two tangents may be drawn to a circle.

These will be real, coincident or imaginary according as $x'^2 + y'^2 - r^2$ is positive, zero or negative, i.e. according as the point $(x'y')$ is outside, on or inside the circle.

48. *To find the equation of the normal at any point on a circle.*

Let the equation of the circle be $x^2 + y^2 = r^2$ and let (x', y') be the point on the circle.

The tangent at (x', y') is $xx' + yy' = r^2$ (i).

The equation of the line perpendicular to (i) at the point (x', y') is

$(x - x')\,y' - (y - y')\,x' = 0$

or $xy' - yx' = 0$ (ii).

This is the required equation, and it is clear that the normal passes through the origin, i.e. through the centre of the circle.

49. The straight line joining the points (real, coincident or imaginary) of contact of the tangents drawn from a given point to a circle is called the **polar** of that point with regard to the circle.

To find the equation of the polar of a point with regard to a circle.

Let (x', y') be the point and $x^2 + y^2 = r^2$ the equation of the circle.

Let the co-ordinates of the points of contact of the tangents from (x', y') be x'', y'' and x''', y'''.

Then the equations of the two tangents will be

$xx'' + yy'' - r^2 = 0$,

$xx''' + yy''' - r^2 = 0$.

Since both these pass through (x', y'),

$x'x'' + y'y'' - r^2 = 0$ (i),

$x'x''' + y'y''' - r^2 = 0$ (ii).

But (i) and (ii) are the conditions that the points (x'', y'') and (x''', y''') should lie on the straight line

$x'x + y'y - r^2 = 0$ (iii).

Hence (iii) is the equation of the polar.

Similarly, if the equation of the circle be

$x^2 + y^2 + 2gx + 2fy + c = 0$,

the equation of the polar is

$xx' + yy' + g(x + x') + f(y + y') + c = 0$ (iv).

If (x', y') lie outside the circle, the two tangents are real, and (x'', y'') and (x''', y''') are real and different; if (x', y') lie on the circle, (x'', y'') and (x''', y''') coincide; if (x', y') lie within the circle, (x'', y'') and (x''', y''') are imaginary; but in **all** cases the line represented by (iii) or (iv) is **real.**

When (x'', y'') and (x''', y''') coincide, the polar is clearly the tangent to the circle.

50. *If the polar of a point (x', y') pass through the point (x'', y''), then the polar of the point (x'', y'') will pass through the point (x', y').*

Let the equation of the circle be

$x^2 + y^2 = r^2$.

Then the equations of the polars of the points (x', y') and (x'', y'') are

$xx' + yy' - r^2 = 0$ (i),

$xx'' + yy'' - r^2 = 0$ (ii).

But since (x'', y'') lies on (i),

$x''x' + y''y' - r^2 = 0$.

Now this is the condition that (x', y') should lie on (ii) which proves the theorem.

51. *To find the length of the tangent drawn from any point to a circle.*

Let the point be (x', y') and the equation of the circle $(x - \alpha)^2 + (y - \beta)^2 - r^2 = 0$.

The square of the distance of (x', y') from the centre of the circle is $(x' - \alpha)^2 + (y' - \beta)^2$.

The square of the tangent equals $(x - \alpha)^2 + (y - \beta)^2$ minus the square on the radius.

i.e. the square of the tangent $= (x' - \alpha)^2 + (y' - \beta)^2 - r^2$ (iii).

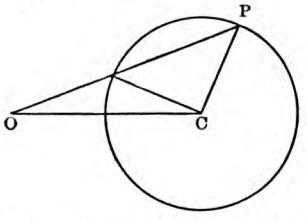
Hence the square of the length of the tangent is found by substituting x' for x and y' for y in the left-hand side of the equation of the circle.

52. *To find the polar equation of a circle.*

We may do this by substituting for x, $\rho\cos\theta$ and for y, $\rho\sin\theta$ in either of the equations of the circle already given.

(Here the length of the radius vector is expressed by ρ.)

Or we may proceed as follows:



Let O be the pole, C the centre of the circle. Let O C be the fixed axis.

Let O C $= d$, C P $= r$, O P any radius vector $= \rho$ and angle C O P $= \theta$.

Then P C^2 = O P^2 + O C^2 − 2O P . O C . cos P O C,

i.e. $r^2 = \rho^2 + d^2 - 2\rho d\cos\theta$

or $\rho^2 - 2\rho d\cos\theta + d^2 - r^2 = 0$,

which is the required equation.

If the fixed axis do not coincide with O C, let O C make an angle α with the fixed axis, then the equation becomes

$\rho^2 - 2\rho d\cos(\theta - \alpha) + d^2 - r^2 = 0$.

If O lie on the circumference of the circle,

$\rho^2 - 2\rho d\cos(\theta - \alpha) = 0 \therefore \rho = 2r\cos(\theta - \alpha)$.

And if in addition O C be the fixed axis,

$\rho = 2r\cos\theta$.

53. If $x^2 + y^2 + 2gx + 2fy + c = 0$ (i)

and $x^2 + y^2 + 2g'x + 2f'y + c' = 0$ (ii)

represent two circles, the equation

$x^2 + y^2 + 2gx + 2fy + c = x^2 + y^2 + 2g'x + 2fy' + c'$ (iii)

will be satisfied by the co-ordinates of any point which lies both on (i) and (ii).

Now (iii) reduces to $2(g - g'x) + 2(f - f')y + (c - c') = 0$ (iv),

which is of the first degree. Hence it is the equation of a straight line passing through points common to (i) and (ii).

Even if the circles do not cut in reality, (iv) represents a real straight line, provided g, g', f, f', c, c' are real.

Now if in the left-hand side of (i) we substitute for x and y the co-ordinates x', y' of any point, we get the square on the tangent from (x', y') to the circle (i).

And if x, y be the co-ordinates of any point on the line (iii), the left-hand side equals the square on the tangent from (x, y) to circle (i), and the right-hand side equals the square on the tangent from the same point to circle (ii).

Hence the tangents drawn from any point of the line (iii) are equal to one another.

The straight line joining the real or imaginary points of intersection of two circles is called their **radical axis.**

From the above it is clear that the radical axis is the locus of points from which tangents to two circles are equal.

The co-ordinates of the centres of circles (i) and (ii) are $-g$, $-f$ and $-g'$, $-f'$ respectively.

The equation of the straight line joining the centres is therefore

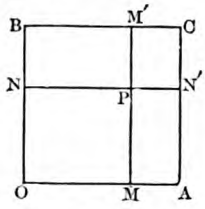
$$\frac{x+g}{g-g'} = \frac{y+f}{f-f'}$$

and this is perpendicular to line (iv).

Hence the straight line joining the centres of two circles is perpendicular to their radical axis.

54.—Examples:—

(1) To find the locus of a point which moves so that the sum of the squares of its distances from the four sides of a square is constant.



Let O A C B be the square.

Take O as origin, O A as axis of X and O B as axis of y, let the side of the square $= a$.

Let P be any point on the locus.

Draw perpendiculars P M, P M′, P N, P N′ on to O A, B C, O B, A C respectively.

Let x, y be the co-ordinates of P.

Then $PM^2 + PM'^2 + PN^2 + PN'^2 = \text{constant} = K^2$

$\therefore x^2 + (a-x)^2 + y^2 + (a-y)^2 = K^2$

$\therefore 2x^2 + 2y^2 - 2ax - 2ay + 2a^2 - K^2 = 0$

and this is the equation of a circle.

(2) To find the locus of the middle points of chords of a given circle, drawn parallel to a given straight line.

Take the centre of the circle for origin and the axis of X parallel to the given straight line.

Let the equation of the circle be

$x^2 + y^2 = r^2$ (i),

let the equation of the given straight line be

$y = K$ (ii),

and let $y = mk$ be the equation of one of the chords parallel to (ii).

Where this chord cuts the circle we have

$x^2 + m^2k^2 = r^2$ and $\therefore x = \pm\sqrt{r^2 - m^2k^2}$.

Since these two values of x are equal and opposite, the middle point of the chord has its abscissa $= 0$, i.e. the middle points of the chords lie on the axis of Y. This is true for all values of K.

The locus of the middle points of parallel chords is therefore the straight line through the centre of the circle.

Exercise 8

(1) Find the points where the line $y = 2x + 3$ cuts the circle $x^2 + y^2 = 5$.

(2) Show that the circles $x^2 + y^2 = 8$ and $x^2 + y^2 + 6x + 6y - 8 = 0$ touch one another at the point $(2, -2)$.

(3) A line moves so that the sum of the perpendicular drawn to it from the points (a, o) and $(-a, o)$ is constant; show that it always touches a circle.

(4) A point moves so that the square of its distance from a fixed point varies as its distance from a fixed straight line; show that it describes a circle.

(5) Find the polar of the point (4, 5) with regard to the circle $x^2 + y^2 - 3x - 4y - 8 = 0$.

(6) Find the condition that $Ax + By + C = 0$ should touch $(x-\alpha)^2 + (y-\beta)^2 = r^2$.

Key to Exercise 7

(1) $x^2 + 3xy - 2y^2 + 5x - 2y - 18 = 0$.

(2) $2xy - \frac{4}{\sqrt{2}}(x+y) + 1 = 0$.

(3) $x^2 + y^2 - 2x - 2y + 1 = 0$.

(4) radius $= \frac{1}{2}$, centre $(-\frac{1}{2}, \frac{1}{2})$.

Key to Exercise 8

(1) $(-\frac{3}{5}, \frac{11}{5})$, $(-2, -1)$. (5) $5x + 6y = 48$

(6) $\frac{A\alpha + B\beta + C}{r(A^2 + B^2)} = r$.

M. A. L.

MENSURATION.—IV

35. Before dealing in detail with the solid figures described in the last lesson, we must consider the question of volume, i.e. of the amount of space occupied by a solid.

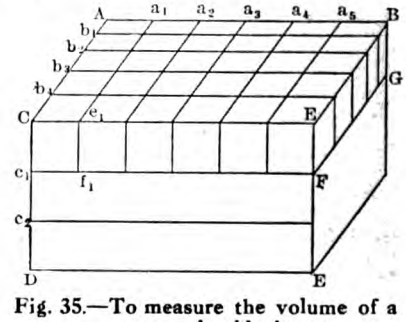


Fig. 35.—To measure the volume of a rectangular block.

The **unit of volume** is a cube, each of the 12 edges of which is of unit length.

The **volume** of a body is measured by the number of such units it contains.

To find the volume of a rectangular block.

Let the edge A B contain a units of length

Let the edge A C contain b units of length

Let the edge C D contain c units of length

Mark off these lengths and draw $\parallel$ lines as in the figure.

Consider the slab at the top, A B E C C_1 F G

It is of uniform height C C_1 = unit of length, and the portion of it marked A A_1 E_1 C C_1 F_1 consists of b cubes of unit volume. Now the whole slab A B E C C_1 F G contains a times as many units of volume $= a \times b$ units of volume where $a \times b$ = area of the surface A B E C.

But as the edge C D contains c units of length, there must be c such slabs

$\therefore$ **volume of the whole block** $= c \times a \times b$

= length × breadth × height.

= area of base × height.

Now consider a cylinder or a right prism.

The total number of units of area in the top surface is the same as the total number of units of area in the base. Supposing the total number of these units of area is *ab* and the height of the cylinder or right prism is *c* units of length.

Then in the top slab there will be *ab* units of volume, and as there are *c* such slabs, the total number of units of volume will be $a \times b \times c$.

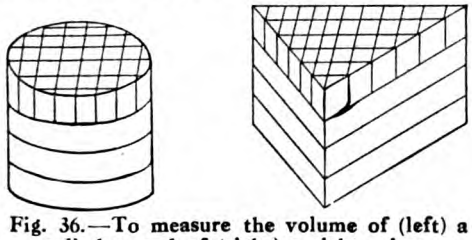


Fig. 36.—To measure the volume of (left) a cylinder, and of (right) a right prism.

Hence

the volume of a rectangular block or of a cylinder or of a right prism = area of base × height.

36. *The volume of an oblique prism is equal to that of a right prism of the same height, whose base is the right section of the original prism.*

Let A B C D E, P Q R S T be an oblique prism.

Let a section at rt. ∠s to its edge be made by the plane $A B^1 C^1 D^1 E^1$.

Imagine the solid body $A B^1 C^1 D^1 E^1$, B C D E removed from the top and placed at the bottom of the prism, so that $A_1 B_1 C_1 D_1 E$ coincide with $P_1 Q_1 R_1 S_1 T$ respectively.

Then clearly the prism A B C D E, P Q R S T is equal in vol. to the right prism $A B^1 C^1 D^1 E$, $P Q^1 R^1 S^1 T^1$ whose base $P Q^1 R^1 S^1 T^1$ is a right section of the original prism and whose height A P is the same.

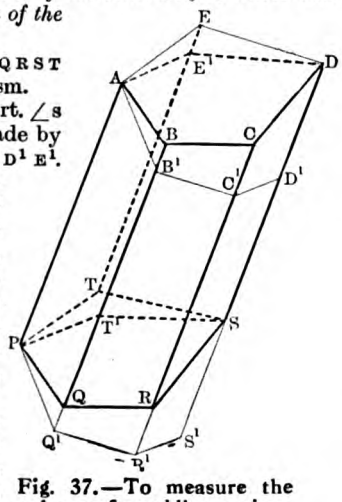


Fig. 37.—To measure the volume of an oblique prism.

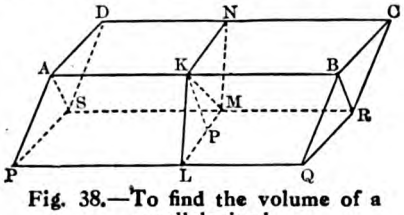


Fig. 38.—To find the volume of a parallelepiped.

Hence, **the volume of an oblique prism = area of right section × height.**

37. *The volume of a parallelepiped is equal to the product of the area of its base and its height.*

Let A B C D, P Q R S be any parallelepiped.

Let a plane K L M N cut the edges A B, P Q at rt. ∠s.

Then by § 35 the vol. of the parallelepiped = K L M N × height = K L M N × P Q

Draw K P ⊥ to L M. Then area of K L M N = L M × K P

∴ vol. of parallelepiped = L M × K P × P Q

But area of P Q R S = L M × P Q

∴ **vol. of parallelepiped = area of base × height.**

Corollary 1.

The volume of an oblique triangular prism whose bases are A S D and B R C equals area of △ N K M × P Q = ½ area of parallelepiped = ½ base A P S D × P Q = △ A S D × P Q

Hence **volume of oblique triangular prism = area of base × height.**

Corollary 2. The volume of any oblique prism = area of base × height.

For any prism may be divided into triangular prisms of the same height, the sum of whose bases = base of original prism (Fig. 37).

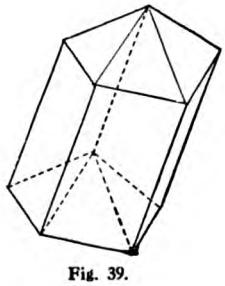


Fig. 39.

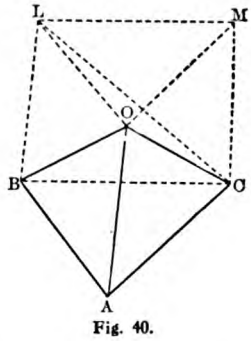


Fig. 40.

38. *The volume of a triangular pyramid is one-third the volume of a prism on the same base and of the same height.*

Let O A B C be a triangular pyramid of vertex O (Fig. 40).

Through O draw O L, O M ‖ to A B, A C respectively, and let them meet the plane through B C ‖ to A O in L and M.

Join L B, M C, L M. Then O L M, A B C is a triangular prism.

Now O B is a diagonal of the face O A B L of the prism.

and O C is a diagonal of the face O A C M of the prism.

Draw the diagonal C L of the face B C M L of the prism.

Planes through these three diagonals cut the prism into the triangular pyramids O A B C, O L M C, O L B C.

Now O A B C and O L B C have equal bases O A B and O L B (∵ O B bisects □ A O L B) and their heights are equal, for they have their bases in the same plane A O C B and they have a common vertex B.

∴ O A B C = O L B C (*See footnote* p. 370).

Again O A B C and O L M C have equal bases A B C and O L M and their heights are equal, since

both equal the ⊥ distance between planes A B C and O L M

∴ O A B C = O L M C [1]

Hence the 3 pyramids are equal and the **vol. of each** $= \frac{1}{3}$ **that of the prism.**

Corollary 1. The vol. of a triangular pyramid $= \frac{1}{3}$ **area of base** × **height.**

Corollary 2. The vol. of any pyramid $= \frac{1}{3}$ **area of base** × **height**

for a polygonal pyramid may be divided up into triangular pyramids the sum of whose base areas = area of original base, and which all have the same vertex as the original pyramid.

Note: Since a cone is the limiting form of a pyramid the above results hold good for a cone.

39. *To find the surface area of a parallelepiped.*

See Fig. 38.

Since the opposite faces of the parallelepiped are equal □s

Surface area = 2 sum of areas A P S D, A B Q P A B C D.

Let A B = a, A D = b, A P = c

Let ∠ B A D = α, ∠ A B Q = β, ∠ D A P = r.

Then **surface area** $= 2(bc \sin \alpha + ca \sin \beta + ab \sin r)$.

Corollary.—In a **rectangular block,** surface area $= 2(bc + ca + ab)$.

40. *To find the surface area of a prism.*

See Fig. 37.

Let the distances between the edges A P and B Q, B Q and C R and so on be d_1, d_2, d_3, ...

Let the length of the prism be l and let A = area of base.

Then **surface area** = 2 A + areas of □s A Q, B R . . . . .

$= 2A + ld_1 + ld_2 + ld_3 + \ldots\ldots$

$= 2A + l(d_1 + d_2 + d_3 + \ldots\ldots)$

41. *To find the surface area of part of a prism cut off by a plane not parallel to the base.*

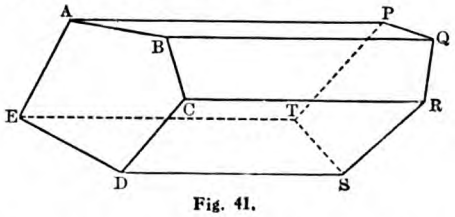


Fig. 41.

Let A B C D E, P Q R S T be the prism. Let A_1 and A_2 be the areas of the ends A B C D E and P Q R S T respectively, which are not parallel to each other.

Let the lengths A P, B Q, C R . . . be l_1, l_2, l_3 . . . .

Let the distance between the edges A P, B Q; B Q, C R . . . . . be d_1, d_2, d_3 . . .

Then **total area** = A_1 + A_2 + areas of trapezoids A B Q P, B C R Q . . . . .

$= A_1 + A_2 + \frac{1}{2}d_1(l_1 + l_2) + \frac{1}{2}d_2(l_2 + l_3) + \ldots\ldots$

[1] This follows from § 30. Cor. 2.

42. *To find the lateral surface area of a pyramid.*

Let O A B C D E be a pyramid (Fig. 42).

Then the lateral surface area = sum of areas of △s O A B, O B C, ...

Let the edges of the base A B C D E be a_1, a_2, a_3 . . . . .

Let the ⊥s from on A B, B C . . . . be b_1, b_2, b_3 . . . . .

Then **lateral surface area** $= \frac{1}{2}(a_1b_1 + a_2b_2 + \ldots\ldots)$.

Corollary 1.—If the pyramid be regular, $a_1 = a_2 = a_3 \ldots\ldots$ and $b_1 = b_2 = b_3 \ldots\ldots$

Hence if a regular pyramid have n sides, **lateral surface area** $= n\frac{ab}{2}$.

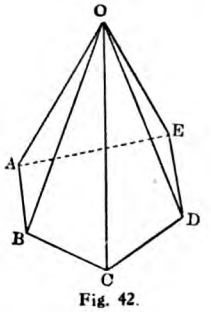


Fig. 42.

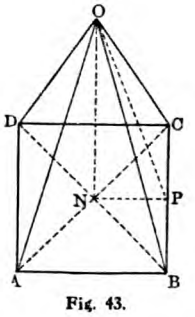


Fig. 43.

Corollary 2.—If the pyramid be a square one.

Let its base be A B C D and vertex O (Fig. 43).

Let $2a$ = length of each side of base.

Let b = height of pyramid, i.e. O N = b.

Let ∠ N P O, i.e. ∠ which each side makes with the base = θ.

Volume = $\frac{1}{3}$ height × area of base

$= \frac{4}{3}ba^2$.

Area of face O B C = $\frac{1}{2}$ B C × O P = $OP^2 = ON^2 + NP^2 = b^2 + a^2$

∴ area of face O B C = $\frac{1}{2} \times 2a \times \sqrt{b^2 + a^2}$

$= a\sqrt{b^2 + a^2}$

∴ **total surface area** $= 4a^2 + 4a\sqrt{b^2 + a^2}$

Further θ = $\tan^{-1}\frac{b}{a}$

If the edges O A, O B . . . . also each = $2a$

then $b^2 = 4a^2 - AN^2 = 4a^2 - \frac{1}{4} \times 8a^2 = 2a^2$

∴ $b = \sqrt{2}\,a$

Hence **vol.** $= \frac{4\sqrt{2}}{3}a^3$.

Total surface $= 4a^2(1 + \sqrt{3})$

and θ = $\tan^{-1}\sqrt{2}$

43. **Regular Tetrahedron.**

Let A B C D be a regular tetrahedron (Fig. 44).

Draw D N ⊥ to plane A B C.

Then N must be the centroid of △ A B C.

Produce A N to cut B C at P. Then A P must bisect B C at rt. ∠s.

Let l be length of any edge.

Then total surface area = 4 area of any of the faces which are equal equilateral △s.

Area of $\triangle$ A B C $= \frac{1}{2}$ B C $\times$ A P $= \frac{1}{2} l \times \frac{\sqrt{3}}{2} l$

$\therefore$ **Total surface area** $= \sqrt{3}\, l^2$.

Let height of A B C D = D N $= b$

$b^2 =$ D P$^2 -$ N P^2

Now N P $= \frac{1}{3}$ A P $= \frac{1}{3}$ of $\frac{\sqrt{3}}{2} l$

$\therefore\ b^2 = \frac{3}{4} l^2 - \frac{1}{9} \times \frac{3}{4} l^2 = \frac{2}{3} l^2$

$\therefore\ b = \sqrt{\frac{2}{3}}\, l$

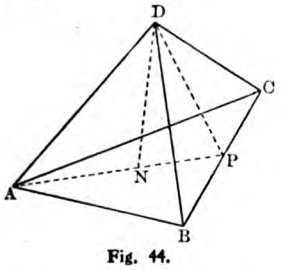


Fig. 44.

Therefore vol. of tetrahedron

$= \frac{1}{3} b \times$ area abc

$= \frac{1}{3} \times \sqrt{\frac{2}{3}}\, l \times \frac{\sqrt{3}}{4} l^2$

$= \frac{\sqrt{2}}{12} l^3$.

Let $\theta = \angle$ any two faces make with each other $= \angle$ D P N

Then $\theta = \tan^{-1} \dfrac{\sqrt{\frac{2}{3}}\, l}{\frac{1}{3} \text{ of } \frac{\sqrt{3}}{2} l} =$ **tan^{-1} 2 $\sqrt{2}$**

Let $\varphi = \angle$ between any face and one of the edges inclined to it $= \angle$ D A N

Then $\varphi = \tan^{-1} \dfrac{\sqrt{\frac{2}{3}}\, l}{\frac{2}{3} \text{ of } \frac{\sqrt{3}}{2} l} =$ **tan^{-1} $\sqrt{2}$**

44. A right circular cylinder.

This is a solid figure generated by the rotation of a rectangle A B C D round one of its sides C D which is fixed and is called the AXIS of the cylinder. The side A B which generates the **curved** surface of the body is called the generating line of that surface.

The sides D A, C B, as the rect. sweeps round, each generate a circle. These circles are called the **bases** of the cylinder.

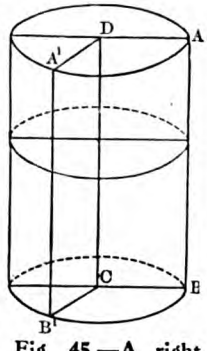


Fig. 45.—A right circular cylinder.

If the cylinder be hollow and it be cut along A B, the curved surface can be flattened out to form a rectangle one side of which = A B = height of cylinder $= b$; the other side = circumference of circle forming the base $= 2\pi r$ where $r =$ D A = C B.

$\therefore$ **Area of curved surface** $= 2\pi r b$

Volume of cylinder

= area of base $\times$ height

$= \pi r^2 b$

45. A **cone** is a solid figure generated by the rotation of a right-angled triangle about one of its sides which is fixed. The hypotenuse generates the curved surface of the cone.

The other side of the triangle generates a circle called the **base** of the cone.

Any plane parallel to the base which cuts the cone will make a section which is a circle.

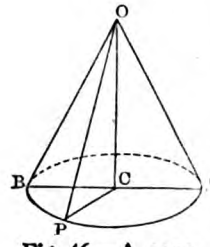


Fig. 46.—A cone.

Since a circle is the limiting form of a regular polygon with an infinite number of sides, a **cone** may be looked upon as the **limiting form of a pyramid** having such a polygon for a base.

Let A B O be a cone. Let C A = radius of base $= r$; let O C = height of cone $= b$; let O A = slant side $= l$; let semi vertical $\angle$ A O C $= \alpha$.

$\frac{r}{b} = \tan\alpha \ \therefore\ r = b \tan\alpha.$

$\frac{r}{l} = \sin\alpha \ \therefore\ r = l \sin\alpha.$

$\therefore$ **area of base** $= \pi r^2 = \pi b^2 \tan^2\alpha$ $= \pi l^2 \sin^2\alpha$.

If the cone be hollow and cut along the line O A, the curved surface may be flattened out so as to form a sector of a circle of radius l of which the arc is the circumference of the circle forming the base of the cone, i.e. 2π 3 (Fig. 47).

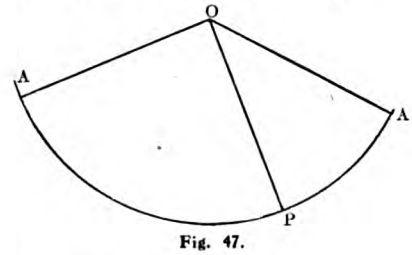


Fig. 47.

Let $\angle$ of the sector $= \beta$

then $\frac{\beta}{2\pi} = \frac{2\pi r}{2\pi l} = \frac{r}{l}$

$\therefore\ \beta = 2\pi \frac{r}{l} = 2\pi \sin\alpha$

$\therefore$ **area of curved surface** = area of sector

$= l^2 \frac{\beta}{2} = 2\pi r l = \pi l^2$ **sin** α

Volume of cone

$= \frac{1}{3}$ height $\times$ area of base $= \frac{1}{3} b \times \pi r^2$

$= \frac{1}{3} \pi r^2 b = \frac{1}{3} \pi b^3 \tan^2\alpha$

$= \frac{1}{3} \pi r^3 \cot\alpha.$ M. A. L.

Continued from page 312.

BUSINESS AND COMMERCE:

***Contributors*:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).**

COMMERCIAL TRAINING.—XL

THOUGH in business and commerce it is a safe axiom to have as little as possible to do with the law, at the same time it is highly important that the business man shall have a keen knowledge of legal procedure and the routine of the courts.

Justice of the Peace

Briefly then, in this country the King stands as the head of Justice ; and the work of every court, judge or magistrate is actually performed in his name. Indeed, for the pardoning of a prisoner, the mitigation of sentence, or the commutation of the death penalty, the ultimate decision is still technically made in the name of the King, though it is the Home Secretary who arrives at the necessary award.

Starting at the very lowest rung in the dispensation of justice, we have the sittings of benches of justices of the peace, most of them landowners and men of local if not wider distinction, for the trial of all types of minor transgression, most of them of a petty nature. These magistrates are assisted in their deliberations and decisions by a clerk, usually a man who has practised as a solicitor, or at least one who has had legal experience. Some benches of magistrates sit two or three times a week ; others at regular intervals under the system of local petty sessions.

On the same lines, though not presided over by a bench, are the police courts in thickly populated districts in which there sits a stipendiary magistrate ; one who has been a barrister or enjoyed considerable legal experience and who is paid a stipend for his services. In such courts there are almost invariably daily sessions.

Next to the police courts in importance come the courts of quarter sessions. As the term implies, they are held quarterly and are presided over by justices of the peace ; though the bench is often augmented by the presence of a stipendiary magistrate. Almost every offence, except murder, may be tried at quarter sessions ; and at borough quarter sessions, where the borough possesses a court separate from that of the county, it is customary for the Recorder to act as president.

So far as the country generally is concerned, we come next to the Assize Courts. Assizes are held, when necessary, in the county towns three times during the year ; and are presided over by judges of the King's Bench, who receive a direct commission from the King to try civil cases ; and also, in legal parlance, to " clear the gaols."

The Eight Circuits

There are eight circuits in the English Assizes—the Western, the Northern, the Midland, the Oxford, the North-Eastern, the South-Eastern, North Wales and South Wales. Middlesex and London are not included in the assize system, civil cases being tried at the Royal Courts of Justice and criminal cases at the Central Criminal Court, situated at the Old Bailey.

Beyond the assizes, we have for England the Supreme Court of Judicature in London ; which is subdivided into the Court of Appeal and the High Court of Justice, the latter being also subdivided.

The Court of Appeal is comprised of the Lord Chancellor, the Lord Chief Justice of England, the Master of the Rolls, and of judges who are Lords Justices of Appeal. These are known always as Lords Justices ; whilst judges who have not been promoted to the Appeal Court are spoken of individually as " Mr. Justice So-and-so." This court deals with the appeals from decisions of the High Court of Justice, or those of any of the judges.

The three divisions of the High Court of Justice comprise the Chancery Division, the King's Bench Division, and the Probate, Divorce and Admiralty Division.

The work of the Chancery Division, which is presided over by the Lord Chancellor, is to deal with the estates of those who have died, to decide upon questions of mortgages, land matters, sale of property, trusts and trustee matters, alterations in or cancellation of deeds, disputes between sellers and buyers of land and similar property, the wardship of infants and the administration of their estates, and the dissolving of partnerships.

The King's Bench Division, presided over by the Lord Chief Justice, deals with every kind of civil action, apart from those to do with land and real estate; and it possesses the power of ordering the production of any person wrongfully detained, under the old law of *habeas corpus*. The bulk of the trials conducted in this division are known as *nisi prius*, its meaning being "unless before" the action has been heard by some other tribunal.

Probate, Divorce and Admiralty

The Probate, Divorce and Admiralty Division is comprised of a President and another judge; and, in the Admiralty Division, there are two assessors, both men who have served as officers in the mercantile marine. The work of this particular division is explained by its title.

Divisional Courts are formed for the hearing of appeals from County Court decisions, and also from cases heard by stipendiary magistrates and recorders; whilst business affecting local government is often taken in these courts.

Beyond the Supreme Court of Judicature there comes the House of Lords, the highest court of appeal we have for England, whilst appeals from Scotland and Ireland are also sent to this tribunal. And it is interesting to note that in lodging an appeal in the House of Lords the prayer of the appellant includes the phrase: "That the judgment appealed against may be reviewed before his Majesty the King in his Court of Parliament," thus taking the matter of justice to its very highest pinnacle.

This, then, covers briefly and broadly the system of administering justice in England; and, to a great extent, correspondingly similar systems obtain in Scotland and Ireland, though the laws of the former country vary slightly. In addition, there are the county courts, to be found everywhere, which give decisions mostly in cases of personal actions and money disputes where the damage or debt claimed does not exceed a total of £100. There are fifty-four County Court circuits in England and Wales, with a judge for each circuit; the latter invariably a barrister of great standing in his profession.

And mention might further be made of the various Ecclesiastical Courts, which have to do with matters concerning the Church. The Court of Arches is presided over by the Archbishop of Canterbury; whilst, in each diocese, there are consistory courts under the presidency of the bishop. There are also throughout the country periodical brewsters' sessions for dealing with licensing matters; and some of our large cities have curious courts of their own, most of them of great antiquity, for dealing with special cases.

From the point of view of the business man, it is probable that the bulk of his experience of legal procedure will be confined to the county court. There is a court for every district; and, in addition, besides the judge of the circuit every court has a registrar who may give decisions in undefended cases and who attends to the routine work.

Debt and Damages

As has already been explained, debt and damages up to £100 may be sued for in the county court; and libel and slander may also be tried there by the mutual consent of the parties.

To institute proceedings in the county court the first step is to lodge the plaint. In other words, the plaintiff goes or sends to the court and so supplies the officials there with the addresses of the parties to the case and the nature of the claim that is made. There is a fee equal to 1s. in the £ of the amount claimed to be paid on lodging the plaint, and the court officials in due time issue a summons to the defendant, calling upon him to appear at the court on a given day in order to show why a judgment should not be entered against him.

The defendant has then two courses open to him. He may admit the claim before the day of hearing, and so save half the fees payable and half of the subsequent costs of the action. On the other hand, he may dispute the claim; and, in this case, need not make public his intention to appear, though (in the case of a default summons) he must within eight days give written notice to the court of his intention to defend.

Appeal may be made to the High Court upon a decision of the county court; and, in some circumstances, either the plaintiff or the defendant in a county court action may claim for the case to be tried by a jury composed of eight persons. **A. B.**

CHOOSING A CAREER.—XLV

Opticians.—An optician is a practical man who executes the orders and prescriptions of the oculist. He must have a shop in a central position and stock, in addition to eye-glasses and pince-nez, such things as telescopes, barometers, thermometers, glass eyes, and similar articles. Many opticians also stock photographic appliances for amateurs.

Practically every optician is a member of either the British Optical Association or the Spectacle Makers' Company, or of both. The address of the former is 199 Piccadilly, London, W. 1, and of the latter Temple House, Temple Avenue, London, E.C. 4. To become an optician apprenticeship is highly advisable, and the calling is open both to men and to women. Terms for apprenticeship vary with the class of establishment, but would not be less than £50.

Painters (House).—Owing to the lead used in the manufacture of paint this is not always a healthy calling, and many workers have to abandon it purely for physical reasons. In many parts of the provinces painters begin as apprentices, serving for five or six years at small but increasing wages, but in other centres a young man starts as a painter's labourer. In the field embraced by this calling there is a good deal to learn—the mixing of dry colours to make paint, the art of applying paint and enamel, the paints suitable to different surfaces, the burning-off of old paint and the repair of surfaces.

Painters (Sign).—Though there are a few firms, such as shopfitters, railway construction depots, wagon builders and others, who employ a permanent staff, the majority of sign-painters or writers are unattached men.

It will be obvious that anyone wishing to become a sign-painter must have a certain amount of artistic ability and also of individuality. The subject is taught in many of our technical classes, but it usually happens that a beginner pays a small premium and becomes an apprentice or learner to an established sign-painter.

Paperhangers.—The trade of paperhanging, like that of painting, is subject to seasonal fluctuations, and, with these in view, many workers couple it with some other calling and become either painters and paperhangers, or even carpenters and paperhangers. Apprenticeship is very seldom followed with this trade. It usually occurs that a boy secures employment as a builder's general labourer and so gains his knowledge.

Paper Makers.—In the large paper-making mills of the country there is employment for a vast army of skilled workers of all classes. In following paper from the wood-pulp or rag stage until it becomes the finished product we should find some of the most intricate machinery of commerce; this mechanism is watched over by specialist engineers and their assistants, most of them after serving a period as pupils at engineering colleges and having continued as engineer apprentices.

In the technical side of the business there are mixers, boilers, calenderers, reelers, packers, warehousemen and many others, and a boy getting an early start in a mill can look forward to a remunerative career and a progressive one.

Pawnbrokers.—It will be obvious that the proprietor in this business must be possessed of very considerable capital, and even a thousand pounds would not go far with a small shop. The pawnbroker's annual licence amounts to £7 10s., and there is an additional charge for those who deal in plate.

Photographers.—This is one of those professions frequently taken up by successful amateurs, who through their hobby, have gained a real liking for the work. There is no fixed rule as to apprenticeship, but some high-class establishments do take premium pupils. In other cases it is for the youth or girl to get a minor post in a photographer's business and to work one's way through the reception room, the studio and the dark rooms.

Press photographers are also, as a rule, keen amateurs who make a start by getting some of their work accepted by illustrated journals.

Pianoforte Workers.—In the actual manufacture of pianos there is an opening for several classes of labour, almost entirely that of boys and men. For instance, there are stringers, markers-off, fitters-up, regulators and others. Boys commence at a few shillings a week for a short period of probation and instruction. No particular knowledge of music is necessary to become a worker in a piano factory, and those who would take up this work should apply personally at the factory nearest their homes.

Pianoforte dealers should first learn from a practical man how to tune a piano; in fact, many workers (either men or women) first set up in business as piano tuners as a stepping-stone towards becoming dealers.

Picture Dealers and Framers.—The

framing of pictures is a trade calling for a knowledge of specialised woodworking, of gilding and of glass cutting. No particularly large capital is required.

Pilots.—A pilot is a mariner who assumes entire charge of a vessel through a dangerous estuary, up or down a river, or over a course with which the captain is not fully conversant. The pilot's responsibility is a heavy one, and he is not allowed to follow his calling until he has passed severe examinations.

Pilots are licensed by the authorities at Trinity House, London, E.C.3, from whom the latest regulations may be obtained. The licence usually costs three guineas, and for each year's renewal a further guinea must be paid.

Plasterers.—These men are found in connection with the building trades, and it requires a good deal of training to understand the mixing of plaster with its correct proportions of hair, lime and other ingredients and the subsequent application. Plasterers are usually paid by piece-work.

Plumbers.—In every district there is a call for plumbers, and the work of these tradesmen has to do with the installation, repair and maintenance of piping and lead work of all descriptions.

To enter this calling—apart from the technical training and education—it is usual for boys to be apprenticed for a period of four or five years. Most plumbers ask a premium of from £10 upwards for apprenticeship, but the worker is paid small though progressive wages from the first. When setting up in business as a master plumber not a great deal of capital is required; and the largest profits will be earned from repair work.

Pottery Workers.—In many parts of the country there are self-contained potteries, but the centre of this business is Stoke in Staffordshire. All sorts and conditions of workers are employed, from labourers who handle the china clay to expert artists who paint beautiful designs.

Poulterers.—The majority of poulterers are also dealers in game; and for this latter privilege they must pay to the State an annual licence of £2, expiring on July 1. The best possible way of learning the business (to which there is no recognised apprenticeship) is to begin as a junior assistant and to work one's way up through the various stages.

Printers.—The printing trade is in the main subdivided into two broad branches, that to do with the printing machines and the side in which compositors are found. It would be impossible for anyone, even an expert, to advise a boy which was the better of the two sides to take up as a career. It may be mentioned, however, that there is often a tendency for the ranks of the compositors to be overcrowded; and that on the mechanical side there are some exceptionally well paid appointments for which the worker may qualify.

Produce Brokers.—This class represents a most important section of the commercial world. As the name implies, a produce broker acts as the receiving agent for produce from abroad or from home centres and sells it on commission.

Experience counts for more than capital when establishing oneself in this business; and even then it requires many years in which to build up a connection both among sellers and among buyers. Those who are not, as it were, born in the business should seek a post of a clerical nature in the office of a produce broker.

Rate Collectors.—Municipal and water rates are invariably collected by men who have gained office experience. A boy who enters the Rates or Accounts Department of a borough or the counting house of a water company will find that with perseverance and a little influence he can attain to the responsibilities of a rate collector.

Restaurant Keepers.—Many chefs and waiters eventually attain to the position of restaurant keeper, which proves that practical experience of the calling is highly advisable; in fact, it would be commercial suicide to open such a business without definite knowledge of the buying of stores, the keeping of books, the management of a staff and the arrangement of menus for such an establishment.

A beginner in this line may start in the kitchen, in the office, or even as a waiter; and, with the better class establishments, a working knowledge of wines and cigars is imperative.

Ship Brokers.—A ship broker is the business agent of a vessel and whilst she lies in his port will pay all dues and accept responsibility for the commercial side of her usefulness. There are ship brokers in every port; and, to enter this calling, one should make a commencement as a ship broker's clerk.

Ship Builders.—It requires an enormous capital to become a ship builder; but, in connection with this trade, there are all sorts and conditions of workers, the majority of whom are well paid. In the drawing offices there are specialist draughtsmen and

designers; in the commercial offices there is an army of pay clerks, book and account keepers, costs analysts and others.

In the ship-building yards there are riveters, caulkers, steel-construction workers, carpenters, painters, electrical workers, fitters and a host of others; and a boy who wishes to enter this calling should have no difficulty in making a start either on the Clyde, the Tyne, the Tees, or at some other ship-building centre.

Ship Chandlers.—The ship chandler is the shore tradesman who supplies a ship with general stores of every description. Soap, brushes and items that rank as household stores must be stocked, together with wire, rope, bells and other purely nautical goods. To learn the trade a junior position should be obtained in the shop or warehouse of an established ship chandler.

Shop Fitters.—In this trade there is an opening for specialist carpenters, joiners and cabinet makers; for sign writers; glass workers; mosaic floor experts and many others. The trade is an important and steady one; but to set up as a master man one should have served for many years as an employee and be possessed of very considerable capital.

Slaters and Tilers.—In some parts lads begin as builders' general labourers and then take up slating and tiling; but, in other parts, there is a system of apprenticeship. As with other of the building trades, the worker should regard this merely as one string to his bow and should take up and master one or two other branches of building activity.

Stationers.—In country districts young men and young women are apprenticed to learn the stationery trade and often live in. In a few instances a small premium is charged. The retail stationer usually deals also in books, magazines and periodicals, and the trade is so wide in its scope that some sort of specialisation is necessary to meet the requirements of the particular district.

Stockbroker's Clerk.—There is much more to be learned than would appear on the surface in the calling of stockbroker's clerk; and those who would take up this career should make an early commencement (at the age of 17 for preference) just after leaving school. With a little influence and personal recommendation it should not be at all difficult to secure a post as junior.

With a view eventually to becoming a fully qualified clerk the lad would spend about two years in the office of his principal in order to master the rudiments of the somewhat intricate office routine; and, if he made satisfactory progress, would for a further period of about two years serve as "House" or unauthorised clerk. Following upon this period of training and tuition, the worker may in due course become an authorised clerk and enjoy the privileges of entering the Stock Exchange, and of transacting business on behalf of his firm.

Stockbrokers.—In the vast majority of cases a stockbroker commences his career as a recognised clerk on the lines mentioned above. It is by far the most satisfactory method of thoroughly learning every detail of the business; and, from another point of view, more economical. The actual routine connected with becoming a stockbroker demands that an influential nomination be secured, that unimpeachable sureties be found, and a heavy subscription paid.

So far as those who would aspire to become stockbrokers are concerned, we would point out that to be successful in the attainment of such a purpose the worker must be possessed of large capital and reserves; and also of a wide circle of influential business acquaintances.

Tailors.—The best way of all in which to become a tailor is to serve an apprenticeship and to work one's way through all the various stages of the calling. Naturally, there are tailors for all classes of the community; and a high-class city tradesman would probably ask a stiff premium for apprenticeship. With the lesser grades, however, the beginner might well expect to start with small wages.

Apprenticeship will bring with it a knowledge of cloths and their treatment; of hand and machine sewing, and eventually of cutting. Experience as an assistant and salesman in a shop will afford some acquaintanceship with fitting, and also with the latest fashions. And, after that, there may come a managership.

In the wholesale clothing factories, where suits are made in a collective way for the retail shopkeeper, much valuable experience is to be gained and the wages are good, taking into account the fact that the work is steady. Women have much to do with the making of men's clothes; but, in the same way, men have invaded women's realms and there are innumerable male tailors who have achieved considerable reputation for ladies' garments.

At all events, tailoring, with its varied aspects, is a very sound trade well worth learning in all its branches, and an established tailor with his own progressive business is a man to be envied. A. C. M.

Continued from page 324.

ENGLISH LANGUAGE AND LITERATURE:

Contributors: ENGLISH LANGUAGE (W. A. Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

POLITICAL ECONOMY.—VIII

WHEN Civil Society is once formed, Government of some kind becomes necessary to preserve and to keep that society in order, commanding what is right and prohibiting what is wrong.

Political writers confine the regular forms of government to (1) A Democracy: when the Sovereign power is lodged in an aggregate assembly consisting of the free members of a community. (2) An Aristocracy: when it is lodged in a council of select members. (3) A Monarchy: when it is intrusted in the hands of a single person.

Each of these forms of government have their adherents and advocates.

The British Constitution

The British Constitution, however, combines the virtues and the imperfections of all, for we have a combination of the three forms of government. The executive power is lodged in a single person, the King, who represents the Monarchy, who acts by and with the advice of the lords spiritual and temporal (which is an Aristocracy or a Council of Select Members), and the Commons in Parliament assembled, which is a democratic assembly chosen by the people from among its own number.

It is often said that the State is the people, but the best authorities agree that the State is the Executive or Governing power and the people is the Nation.

State action is the sum of the State's activities exercised within the limits of constitutional principles.

The true functions of the State are twofold, viz. negative and positive.

The negative functions are to administer the law as between disputants, to defend the country against invasion and to insure that the rights of property are respected, to maintain law and order.

The positive function of the State is to make the laws. A system of negative justice is not sufficient, a policy of *laissez-faire*, allowing matters to drift, would press hardly on one class of the community; if for instance the policy of the State towards poverty and sickness was simply a negative policy, the evil might grow until it became a menace to the peace of the community.

Considered by itself a mischievous act may seem to be useful or harmless.

If for instance a poor man steals a handful of food from a rich man, the act considered by itself is harmless or positively good. One man's poverty is assuaged with the superfluous wealth of another. But if such a system were encouraged, or if the act were not punished, thefts would become general, there would be insecurity of property.

Law and Equity

Without security there were no inducement to save and no accumulation of Capital. Without the accumulation of Capital there would be no fund for the payment of wages or the various helps to labour which augment its productive power. Frequent invasions of property would tend to bring the rich to poverty and aggravate the poverty of the poor.

The State, being the executive power and the established defender of property, has the right to settle the conditions on which it will grant its protection; and the community, in consideration of the security guaranteed by the State, is bound to submit to the rules and restrictions which the State may impose.

The State, however, should always be guided by the same moral rules which bind the individual. What would be unjust if

done by the individual does not become just if done by the power of the State. The principle of perfect equity should therefore regulate the actions and decrees of the State.

In order to carry out its duties the State must be provided with money, which it obtains by levying taxes, to maintain external and internal order.

Adam Smith considered that the principles of taxation might be deduced from four rules which he calls the canons of taxation :—

1. Taxation should possess equality.
2. There should be no uncertainty with regard to the amount to be levied.
3. The tax should be levied at the most convenient time, and in the most convenient manner.
4. The State ought to obtain as much as possible of the whole amount which is levied from the tax payer.

There are, however, other principles to be taken into consideration.

Taxation should not be predatory, confiscatory, nor discriminatory against private enterprise.

Concerning Taxes

It is contended that :—

(a) All those exercising political power, and those benefiting from the organisation and security of the State should recognise the obligation of bearing taxation.

(b) All taxation should be as light as possible, consistent with the security of the nation, and should be placed on income and not on capital.

(c) Taxes, whether direct or indirect, should be imposed in the interest of the nation as a whole and not of any particular class.

(d) Taxation should not be vindictive. It should be imposed with the object of securing a benefit, not of inflicting an injury or by way of a penalty.

(e) Taxation should be imposed in such manner as to profit the Exchequer at the least possible expense for collection.

(f) Taxes should not be imposed so as to destroy the sources from which they are obtained.

(g) Taxes should encourage native in preference to foreign industry.

(h) Taxes should be so regulated that all who use a market should contribute to its upkeep and maintenance.

Taxes are either direct or indirect.

A Direct Tax is a tax which is paid personally, and is not shifted or transferred, but is levied at once upon the individual who is intended to bear the burden ; the Income Tax affords the most obvious illustration of direct taxation.

Indirect Taxes are taxes on goods which are shifted or passed on to the consumers ; thus indirect taxes ultimately have the effect of increasing prices.

Indirect taxes have the advantage of being less obtrusive, they are obscured in the mode of collection and so evoke less opposition than direct taxes, they are also paid in small amounts and are less onerous, and can be arranged to touch all classes of the community.

Income Tax

We cannot deal fully with all the taxes which are imposed, but it is interesting and instructive to note the development of the Income Tax, a tax which attracts the attention of every succeeding Chancellor of the Exchequer.

The Income Tax was evolved from the earlier Poll Tax, which was an arbitrary tax imposed in the fourteenth century and continued at intervals up to the year 1698. What is now known as Income Tax was first imposed by Pitt in 1799 for the purpose of the War ; it was suspended in 1801, imposed again in 1803 as a Property and Income Tax, and existed until 1816.

From 1816 to 1842 it was in abeyance. In 1842 the tax was again introduced as a Peace Tax by Sir Robert Peel for a term of three years ; it was then renewed and from 1846 it has become a recognised part of our system of taxation.

Some authorities contend that the Income Tax should be regarded as a National reserve, and only imposed in time of war. It is regarded in that nature, as it is always increased to meet special war expenditure.

In 1874 Mr. Gladstone proposed to abolish the tax on the ground that it was intended as a war tax, but was not successful.

In nearly every country there is Income Tax in some form or other, but the incidents vary considerably.

On p. 319 we showed how at one time all lands were held directly of the King as the Lord Paramount, that the holders of land were bound to render service for the lands they held. These services were gradually discontinued, and a money payment was made in place of service. From Edward III. these payments varied con-

THE SOUTH SEA BUBBLE,

From the painting by E. M. Ward, R.A.

which burst in 1720 and reduced thousands of people to beggary, was the result of an audacious scheme, actually adopted by the Chancellor of the Exchequer, to wipe out the National Debt by inducing holders of Government annuities to take in exchange stock of the South Sea Company, which came to an inglorious end during the frenzy of speculation which followed its inception.

siderably, not only in amount but in the method and time of collection.

Sometimes weekly assessments were made, at other times monthly, until finally a perpetual land tax was fixed at 4s. in the £ by statute of George III., the holder of the land, however, having the option of redemption by buying Government Stock or Consols yielding a dividend exceeding by a tenth part the amount of the land tax.

Government securities were at this time very low on the market, and a great part of the Land Tax was redeemed until, at the present time, the tax only yields an exceedingly small sum annually compared with the value of the land which, to some extent, accounts for the agitation for a further tax on land values.

Land, however, is subject to Succession Duties and brings in a large revenue from this source. The other duties levied on estates passing by death are Probate Duty, Legacy Duty, Account Duty and Estate Duty.

Free Trade *v.* Protection

For some years now the question of securing a part of the revenue from a tax on imported articles, more particularly manufactured goods, has been advocated.

The Tariff Reformer or the advocates of a reform in our fiscal system contend that a serious phase in the position of this country has been reached, entirely owing to the entry into the industrial area of great and growing rivals.

Instead of other countries supplying the raw materials and England providing the labour, there has been a complete change, and foreign countries obtain raw materials as abundantly and as cheaply as we do in this country, and, with the aid of large-scale production, turn out finished articles to compete with those in which we once held a practical monopoly.

It is contended that while other countries have protected their industries by imposing a tariff or a tax on imported goods, we allow the same countries to send their goods to us to compete in our markets with our own manufacturers who have to contribute to the taxes both imperial and local, while the foreign manufacturers pay nothing towards the taxes.

On the other hand it is contended that Free Trade is only an application of the simple principle that the most efficient modes of production yield the largest wealth. The richer the community becomes by adopting the most efficient methods, the better will it be able to contribute to taxation in other ways.

No duty which is protective in its operation can become a productive revenue tax—the two aims are incompatible. In so far as a tax protects it yields no revenue, and in so far as it yields a revenue it does not protect industry.

Import duties, as a rule, fall upon the countries which impose them. If a country attempts to impose a tax on imports from a country which is also a customer, that country will retaliate by imposing other duties, with the result that both will suffer.

Tariff Wars

Instances are given by the Free Trader of the Tariff wars between France and Italy in 1888-98, Germany and Russia, 1892-95, France and Switzerland, 1892-95.

While the Tariff Reformer gives instances of Taxes raised against this country by other countries, contends that while we tax what it calls the breakfast table, we allow manufactured articles to come in free of duty.

The campaign has been carried on between the two parties for some years, and economists are ranged on both sides. It is a most important problem; as it embraces issues of the gravest nature affecting both the production and distribution of wealth, as well as the agricultural question, the food supply and the social problems, it is therefore worthy of the closest attention.

We have only so far dealt with Imperial taxation or taxes levied for State purposes. It must not, however, be forgotten that a large sum is extracted from the community, or at all events directly from the householder, in respect of local expenditures which are called Rates.

Rates are levied on land, houses and trade premises on the basis of the net rent valuation by local authorities in limited areas, which vary in extent and in rateable value—hence the rates vary in different localities.

Rates are compulsory contributions for common services; the benefits derived are more apparent than from Imperial taxation, as the revenue is spent in providing conveniences in the area in which they are levied for road sanitation, lighting, parks, water, police, and poor relief. Some of these services are, however, of a more or less national character, and the Imperial Exchequer contributes approximately about one fourth of the total expended.

Rates are levied on the occupiers, but it is safe to say that a portion of the rates fall on the land owner, as a tenant in calculating

the amount he has to pay annually takes this portion of the rates into consideration, and the rent is accordingly depreciated by that amount.

The Poor Law is an ancient institution which dates back to 1601. It has always been considered to be the duty of the community to care for its poor; no man, woman or child may starve, but it is agreed that our system of Poor Law requires amendment.

Royal Commissions have been appointed and various schemes have been suggested, but although numerous amendments have been made, the system has not as yet been thoroughly revised. It is suggested that the system degrades and pauperises those who are compelled to accept relief.

Old Age Pensions

There is also a class who cannot provide for old age, and to this class the State has a particular duty. The Old Age Pensions Act made a certain provision for them. This provision is provided for by the Imperial Exchequer, and not out of the local rates.

Statistics show that local rates have had a tendency to increase enormously during the last two or three decades. Some economists attribute this increase to the extension of Municipal Trading. How far a Corporation or local body should embark in trade is a very vexed question. Some economists claim that a local body is not only entitled to, but that it is the duty of a local body to provide services for the community.

The principal argument against Municipal Trading is that the local body enters into competition with the individual, and in the event of there being a loss, such loss falls upon the rates. J. W. U.

PHILOSOPHY.—XIV

THE two main points of view of the problem of knowledge are the realistic and the idealistic.

Absolute or naïve realism asserts that external phenomena impress themselves upon our minds as an exact copy of reality: things not only *are*, but are as they appear. The primary no less than the secondary qualities " are really in them," whether they are perceived or not: they exist as they are perceived.

Pure or absolute idealism on the other hand rejects altogether the idea of an extramental world: all we are aware of, all we know, or can ever know, are our own states of consciousness—*Esse est percipi.*

A modified form of idealism contends that something exists, or that " happenings " take place, apart from our consciousness, but inasmuch as our knowledge of it is tinctured by the mind, its real nature is wrapped in mystery.

A theory of knowledge which seeks to weave together the discordant elements of realism and idealism is the " critical " philosophy of Immanuel Kant (1724–1804). Before describing the Kantian philosophy, it will first be necessary to treat of certain views of Locke and Hume which stand in direct genetic relationship to it.

"Critical" Philosophy

By " critical " philosophy we understand one which concerns itself with the limits of possible knowledge, with the conditions which make knowledge possible, with the answer to the question: What *can* I know?

Locke stands out among modern philosophers as the initiator of this line of thought. He gave as the objects of his investigations " To inquire into the origin, certainty, and *extent* of human knowledge," and although he did not carry his inquiry very far, he yet succeeded in slaying more than one traditional myth which cumbered the path of free epistemological investigation. *Inter alia*, he successfully combated the Cartesian doctrine of " innate " ideas—that certain notions like God, mind, and body do not originate in experience but are ready formed in the mind—showing that they are not found in the minds of all men, and that all ideas can be referred back to sensations, or to reflection upon the data given in sensation.

Apparently, under the Lockean " idea," we must include contents of the mind other than concepts, e.g., intuitions, images and volitions: but on the other hand his classification of ideas into simple—those which are given in sense (sense-perceptions)—and complex (concepts) seems to exclude volitions or desires.

By emphasising the importance of sensation as a source of knowledge, he circumscribed the field of possible knowledge to a large extent. The simple ideas " represent things to us under their appearances which they are fitted to produce in us," and since complex ideas were the issue of simple ideas, it followed that our knowledge was only relative.

To John Locke, the metaphysical entities, substance, things-in-themselves, etc., were " behind the veil " of possible knowledge, for there was no clue to them given in

sensation upon which the "reflective consciousness" could operate and from which it could deduce valid conclusions.

Hume (1711–1776) pursued the same psychological method, but he emphasised more clearly than Locke the distinction between sensation and thought. The contents of the human mind were "impressions"—the primal sensations, passions, and emotions—and "ideas," which were the faint images of the impressions and the actual materials of thought. Thus "idea" in this case is apparently restricted to "mental images."

He analysed the idea of "substance" and rejected it because it was merely a "collection of simple ideas united by the imagination," and in a similar way he dismissed the idea of an ego, the hypothetical substratum underlying mental phenomena. Just as Berkeley had pulverised objects by proving them to be mere bundles or groups of perceptions, so Hume disintegrated the "soul" into a flowing stream of individual feelings and ideas: the unity of consciousness is a "constant," and corresponds to no impressions given in sense-experience; therefore it is an illusion.

Human Understanding

In his *Essays on the Human Understanding* (1741–1757), Hume sought to dissipate the validity of causation, which in his opinion connoted power. "The simple view of any two objects or actions, however related, can never give us any idea of power or of a connection betwixt them; this idea arises from the repetition of their union: the repetition neither discovers nor causes anything in the objects, but has an influence only on the mind by that customary transition it produces; this customary transition is therefore the same with the power and necessity, which are consequently qualities of perceptions, not of objects, and are internally felt by the soul, and not perceived externally in bodies."

Now it was while pondering over this very subject that Kant felt the impulse to set to work on his critical philosophy. "It was the remembrance of David Hume," he wrote, "which interrupted my dogmatic slumber many years ago, and gave a new direction to my investigations in speculative philosophy." The method and results of Kant's inquiry are to be found in the famous *Critique of Pure Reason* (1781), a work which is unfortunately written in a tedious and obscure style, replete with wearisome repetitions, and containing not a few contradictions.

It took Kant twelve years to think out the materials of the *Critique*, but only five months to put them in writing. The student will find the later work, *Prolegomena to every future Metaphysic* (1783), which deals with the same problems, much easier to understand. The reader is also referred to the excellent article on Kant in the *Encyclopædia Britannica*, parts of which have been of great assistance to the writer in the following attempt to sketch the main points of the "critical" philosophy.

Philosophy of Kant

With reference to his general epistemological position, Kant himself compared it with that of Copernicus in another sphere. Copernicus, dissatisfied with the prevailing view that the heavenly bodies revolve round the earth as centre, tried the effect of imagining these bodies to be at rest and the earth itself to move. Similarly, the sage of Königsberg, disappointed with the sterility of the view that the human understanding adapts itself to, and directs itself by, external objects, sought to achieve better results by regarding the objects as adapting themselves to the mind.

Kant is sometimes credited with having held the view that we can have knowledge *a priori*, using that term in the sense of "innate" knowledge ready formed in the mind, but this contention cannot be justified. The very first words of Supplement I. to the *Critique* run: "There is no possible doubt that all knowledge originates in experience," and in the succeeding sentences he says that sensation provides the *raw material* of knowledge, not knowledge itself. In this he saw eye to eye with Locke, but unlike the latter, he did not regard the mind as merely a blank sheet of paper—a *tabula rasa*—upon which external objects make their impressions: knowledge is rather a product of the union of two elements—of something external to us and of our own consciousness, i.e., of object and subject.

How is this union, or synthesis, effected? By certain functions or operations of the understanding. These alone make knowledge possible, in other words they are *the conditions of the possibility of knowledge*, and this is what Kant means when he calls them *a priori* or "pure."

The critique or criticism of the pure reason consists in showing how these conditions necessarily limit the range of human knowledge. Kant called his philosophy the "transcendental philosophy," meaning there-

by that it was concerned with determining the conditions of the possibility of knowledge.

According to the transcendental psychology, the process of acquiring knowledge (cognition) is the outcome of two factors, the "sensibility" and the understanding. Although these are inseparably united in cognition, yet for the purpose of critical inquiry they are separated in thought and dealt with in isolation.

Space and Time

Sensibility is a passive faculty, the capacity to receive sense-impressions (*Wahrnehmungen*) from the outside; it is also called a Receptivity, in contradistinction to the understanding, which is an active faculty that elaborates the data furnished by the sensibility. "Sensibility and understanding are the two stems of human knowledge, which (according to the first edition only of the *Critique*) perhaps proceed from a common source in some manner unknown to us."

Objects are given in the sensibility; by the action of the understanding they become thoughts or concepts, i.e., sensation provides as it were the bricks and mortar out of which the understanding constructs the building of knowledge.

A veridical concept must be referable to sensibility and sense-perception. Sense-impressions are always presented to us as arranged in definite ways or modes, i.e., as existing in space and time. Space and time are forms or modes of perception and are "pure intuition." The letters of the alphabet can be arranged in many different ways, and the alphabet itself consists of the letters arranged in a definite way. The existence of the letters themselves and the existence of this definite order are two very different kinds of existences. The alphabet is a definite *mode* of arrangement of the letters.

In some such way space and time are the modes of perception. When we perceive objects we always conceive of them as existing in space and time: we cannot divest our minds of these, therefore they are necessary elements in cognition. We cannot imagine space to be non-existing, but we can easily picture the disappearance or annihilation of objects. The possibility of conceiving anything as existing outside me, or of conceiving one object to occupy two different places in succession, lies in the subjective nature of space.

Space is a condition of the possibility of experience. It is not perception itself, nor is it a concept like "horse" or "dog": it is a permanent element present in all perceptions. When Kant says, space is "pure" intuition, he means that it goes *before* perception, not as preceding it in time, but as conditioning its possibility. Similarly with regard to time, it is an invariable mental element in all perceptions, and as such it renders knowledge possible.

Summary

If A be the subject, and B the object, the object of epistemology is to define the relation between A and B.

Naïve realism (common sense) asserts that in perception A receives direct knowledge of B as it is in itself.

Pure idealism states that B does not exist at all; all A knows is his own states of consciousness.

Kantian idealism affirms that all knowledge is the outcome of the union of A and B.

Locke and Hume were the immediate forerunners of Kant, whose "critical" philosophy aims at determining the limits of possible knowledge.

The *Critique of Pure Reason* is a work which has created a profound and lasting impression upon epistemology.

Sensibility and understanding are the two subjective factors in cognition. The former receives the "raw materials," the latter effects their synthesis.

All sense-perception takes place under the forms of time and space, and these are "pure" or *a priori* because they condition the possibility of knowledge.

E. H. T.

ETHICS.—IV

ETHICS holds that the justification of a moral act must itself always be moral. A good act, it says, should be done *because* it is good, and not on account of any reward which may accrue from it. In the minds of some people this theory concerning reward brings Ethics into conflict with some of the tenets of our faith. It is part of our faith that heaven will be the reward of a good life upon earth, and the great majority of us would be very grieved to surrender this prospect for any other.

On this point, however, Ethics is uncompromising. It directs that good actions should be done for no other motive than for the sake of doing good actions. Here, again, we are brought face to face with conditions upon which we have already touched briefly. These are those affecting the man who has been shown to perform actions that are in tune with his real self. Although he performs good acts for the sake of performing good acts, he does so unconsciously, and it is only when his deeds

fall below the spiritual plane to which he has raised himself, that his discomfort reveals to him the fact that he has not been acting in a fashion true to himself.

This, according to Ethics, is the real meaning of what is generally termed conscience. It will be realised from this that the science with which we are dealing sheds some very notable lights on the spiritual conditions, without necessarily disturbing the inner meaning and the ultimate end in the very least.

Self-denial and the Moral Ideal

Arguing on lines such as these, we arrive at the theory that the pangs of self-denial have no real existence in the moral life. A failure to carry out the acts or omissions, which are generally supposed to constitute self-denial, would merely mean that the man who was leading a moral life would suffer the disturbance that follows an act foreign to his spiritual self. Dr. G. A. Johnston has expressed this very clearly in his *Introduction to Ethics*:

"Self-denial cannot be the ultimate moral ideal. For self-denial as the absolute moral end would involve the abnegation of the *whole* self; and that is impossible. It would imply not merely the sacrifice of a man's private self, but also the renunciation of the family and the State and the Church. And no apostle of self-denial has ever advocated that. However extreme an ascetic may be, he never denies the *whole* self. Ascetics have commonly renounced the family and all social and political relations, but they have done so in order to develop and assert the religious self, which for them was the widest and truest of all. Absolute self-denial is a contradiction in terms. When a man gives up everything for the sake of the kingdom of God, he does so because his self is wholly identified with the kingdom of God. He denies certain aspects of the self for the sake of the highest and most comprehensive self."

We may now consider a few of the questions concerning what is commonly termed the *Values of Actions*. The precepts of Rudolf Eucken are generally considered somewhat unorthodox, and, indeed, he may almost be said to have founded a school of his own. But no student of Ethics could possibly find any matter for controversy in his most lucid statement to the effect that: "The value of an action depends on loyalty to principle and not on the greatness of what is achieved."

This, of course, does not in itself constitute a new discovery. It is surely quite clear from the moral point of view, that the action of an old and feeble man in carrying a child across a puddle of water in the road is of infinitely greater value to the world and to humanity than that of a youthful and powerful conqueror who sets a dozen villages in a blaze, and who slaughters some hundreds of women and children in order that his name may be carved more deeply and redly on the pages of history.

But in endeavouring to arrive at the values of actions there is much more to be taken into consideration than such obvious contrasts as these. In weighing an action it is necessary to consider fully the circumstances amid which it takes place.

Most of us have read how it was the custom of the Spartans to teach their boys to steal, and to punish them if they were discovered in the theft. In other lands and other times a procedure of this sort would be confined to the criminal classes, but in the Sparta of that day, the shame lay not in the theft, but in the fact of being found out. Social convention made the theft itself—the undiscovered theft—a meritorious act. In Sparta, therefore, a successful young thief, receiving congratulations and applause, experienced the full glow of pride such as is known by the honourable and honoured.

The Cannibal Code

Similar conditions prevail amid certain of the savage races of to-day. Thus an affectionate parent of a cannibal race will forgo the best pieces of his dead and roasted human prey in order that his offspring may have the benefit of the most succulent morsels. And in doing this he will experience the sentiments of warm lovingkindness and care that is the lot of all conscientious and dutiful parents!

How are these happenings and these sentiments to be reconciled with the laws of morality? At the first glimpse, the mere possibility of their existence would seem to stultify almost every one of the theories that we have been endeavouring to point out. But when it is explained that they fall within the category of social convention, it will be evident that they do not alter the general trend of the theories in the very least.

It has been very truly said that social conventions have only local validity, and that true moral judgments are universally true. Acts done under the force of social convention are of very little ethical value whatever they may be. The tendency is,

therefore, for social convention to rob an act of much of its significance, whether it actually works towards good or towards evil.

The same may be said of blind obedience. It is obvious that one person who acts merely as the tool of another cannot claim the merit of a goodly action done at the command of the other; and by the same reasoning he must escape much of the blame following a bad deed. It is possible, of course, that he may act thus in defiance of his own sentiments; but in that case the obedience could not justly be said to be blind, and here it is clear that the doer must take a great part of the responsibility for the action.

While dealing with these various aspects of action we may turn to the consideration of the importance of habit. There is no doubt that habit, like fire, is a good servant but a bad master. There is much to be said in favour of the formation of habits. But it should always be held in mind that habit should be regarded as a means and not as an end.

There are many most estimable people who are given to regard the accumulation of a certain number of good habits as the chief aim and object of life. They are given to confining themselves to such ideals as those expressed in the proverb, "early to bed and early to rise maketh a man healthy, wealthy and wise." This adage is, of course, admirable; but it was never intended to imply that health, wealth and wisdom were to be looked forward to as the *ends* of existence. Far from it. They serve merely as a staff by which journeys to the higher planes may be facilitated.

Importance of Good Habits

Habits are of service in this way: that a man who has to work many hours of the day can set himself much more easily to his task if he has acquired the habit of rising at, say, six o'clock in the morning, and can thus give a period of time to his work that will render it far more satisfactory than if his hours were irregular, and he had either to work far into the night or to suffer the mental upset due to the unaccustomed strain of early rising.

The importance of good habits is not to be over-estimated. At the same time it is very easy for the force of habit to arrogate to itself a place in human life to which it is not in the least entitled. Thus it is by no means an uncommon thing for a man, who has become accustomed to carry on his career in an office at set hours, to find the utmost difficulty in breaking away from the occupation. Many a man, in fact, when he has made for himself a financial independence that should set him free for the contemplation of a wider horizon of life, has found himself in a mentally depressed and wretched condition from the mere fact of being separated from the particular habits of work to which he had grown accustomed during many long years.

It has frequently happened that a man of this kind has, after his retirement, found the call of his late occupation so powerful that he has gone back to it, and has ended his life in harness. From some points of view an action such as this may be regarded as meritorious. It displays an energy, for instance, which is invaluable for the struggle towards the higher life.

Slaves of Habit

Nevertheless, in a case such as this the energy has undoubtedly been misdirected. The man, in fact, has become the slave of habit. In one sense it will be found that he is as much a slave of habit as is the drunkard and the drug taker, although, of course, the physical results are not pernicious, so far as he is concerned. The main fact remains, that he is a slave to his material circumstances, which condition must be considered reprehensible by Ethics, which starts with the emphatic assertion that every man is free. A man, therefore, who has sacrificed his freedom even in such matters as those of habits, has not made the complete moral advance that is expected of him.

Such circumstances as these, nevertheless, do not in the least affect the desirability of acquiring good habits. A new habit inculcated into the moral machinery may be likened to a dose of oil applied to the wheels of an engine. Desirable new habits should be watched and guarded like young plants in the very early spring. It has been laid down as a maxim that no exception should be permitted to a habit until it has become firmly rooted into the life of the person who has acquired it, and it cannot be doubted that this advice is sound from the practical point of view, which Ethics is bound to encourage wherever it can.

The important corrective to excess or obsession of the moral nature, as affected by habit, is that of the exercise of control, articulated to, and stimulated by, a sane appreciation of action values. This function of an acute, observant, and receptive mentality acts as a compensating balance upon the inner motives, governing the *purpose* and the *end* of moral conduct. W. H. K.

Continued from page 344.

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***Contributors*:—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).**

BOTANY.—XXV

82. Algæ.—We have hitherto considered exclusively the habits of flowering plants; but there is in addition a whole world of flowerless plants (Cryptogams), full of interest and variety, but more difficult to study without the aid of a microscope. Though no flowers are produced, the process of reproduction is effectively carried on, in some cases by complex and deep-seated methods.

At the foundation of the vegetable kingdom, we have a vast class of plants known as *Thallophytes*, in which the plant body shows no true differentiation into stems, leaves and roots. Two large divisions of the thallophyte class exist: the *Algæ* and the *Fungi*, differing chiefly in their mode of nutrition, the Algæ being chlorophyll-containing plants and the Fungi parasites or saprophytes.

The Algæ are natives of the water, fresh or salt, and damp earth, which seems to point to the water as the original home of life. They are of various colours—green, red, brown, blue-green; but chlorophyll is always present, though sometimes disguised by other pigments. The Algæ therefore live as other green plants do, on carbon dioxide, obtaining it of course from the water in which they thrive.

The simplest Algæ are unicellular and require high magnification for their effective study. A typical form is *Pleurococcus*, of which the green scum often noticed on the bark of trees largely consists. Under the microscope, this scum is found to consist of an abundance of oval cells, showing their cell-wall distinctly, and their protoplasm in which the chloroplasts or grains of chlorophyll are embedded. Several different kinds of unicellular Algæ can often be found in a drop of rain-water which has remained stagnant in a water-butt for some time. Reproduction is commonly effected in these lowly forms by simple division; but in some of them more complex processes have also been observed.

A stage further in plant-evolution is represented by the filamentous Algæ which are especially numerous in fresh water, running or stagnant. In the mass of tangled threads which, during the summer, come to or near the surface, the microscope will often reveal several different species, characterised by the beautiful development of their chloroplasts. In one common species, *Spirogyra*, each cell of the ribbon-like filament has a spiral chloroplast. Reproduction in this case is effected by *conjugation*, a process in which two cells of different filaments take part; but to all appearance the two cells are quite alike, and the sex-element is not present, except in the fact that two cells are needed to form the *spore*, i.e. the special cell from which the new plant is formed.

True sexual reproduction exists, however, in other filamentous forms; and the special cells for the purpose can be seen in *Vaucheria*, an alga which forms a felt-like covering of fine threads on the damp soil of flower-pots in hothouses or at the bottom of ponds. Here the two conjugating elements are not alike, and hence we have the beginning of the distinction which culminates in the ovule and pollen-grain of the higher plants.

The most familiar Algæ of all are the

seaweeds, which, as is well-known, inhabit the shallow waters near our sea-coasts. Some swim freely in the open sea, while others attach themselves firmly to rocks and stones. The organ of attachment is not, however, a root, though it differs from the rest of the thallus: it does no more absorption than the rest of the thallus—less, in fact. The common brown seaweed or bladder-wrack (*Fucus vesiculosus*) may be taken for examination. The thallus is flattened, and branches by a simple dichotomy; it has a thickened midrib which contains no vessels or other specialised conducting tissue; and bears

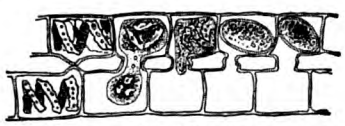

Fig. 191.—An example of the filamentous Algæ, Spirogyra in which each cell has a spiral chloroplast, reproduction being effected by conjugation.

here and there the familiar bladders which are no more than large air-spaces aiding flotation. Sometimes a piece of the seaweed will be found with one or more of the branches swollen, and rougher than the rest of the thallus; these special branches are called *receptacles*, and it is on them alone that the reproductive cells are to be found. These are formed in little spherical holes in the receptacle, called *conceptacles*, the position of which can be recognised under a lens as the plant dries, by the minute drops of water which remain adherent to their mouth. Male and female cells are formed in special organs in different conceptacles. The male cells (*spermatozoids*) are exceedingly numerous, very minute and very motile; the female (*oospheres*) are few, large and incapable of motion on their own account. A fertile spore is formed only when a spermatozoid enters and fuses with an oosphere, which happens in the open water. Thus we have a complete separation of the sexes, in this formation of two quite different but equally necessary reproductive cells.

83. Fungi.—The Fungi are doubtless to be regarded as degenerate Algæ which have become adapted to parasitic habits. They are characterised by a complete absence of chlorophyll, making them dependent on organic matter in some form for their staple food, and by the subordination of the whole of the plant's activities to the work of reproduction.

Thousands of Fungi are saprophytes, and live on dead or decaying organic matter. Examples are many bacteria, yeast, moulds, mushrooms, etc. The two former are unicellular, and can readily be examined under the high power of a microscope. They produce chemical changes in the material on which they live, which are of great importance. Thus, yeast feeds on sugar, and produces alcohol and carbon dioxide during its metabolic processes.

The white fluffy mould that forms on damp jam left exposed to the air is a fungus called *Mucor*. Its body consists of a very delicate and much-branched thread, called the *mycelium*, which is contained entirely in the substratum. From this mycelium, erect branches grow up into the air, on the ends of which spherical cases develop (*sporangia*) each containing a large number of spores. These spores are exceedingly light, and remain in the air an indefinite time, so that suitable material is certain to become mouldy if it is left exposed to the air. These spores are not produced as the result of any fertilising process; but when the weather is unfavourable or the material becomes scanty,

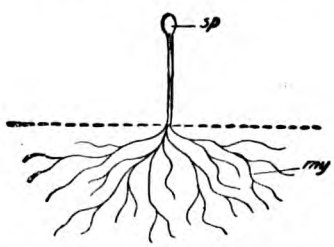

Fig. 192.—The mould that forms on damp jam left exposed to air is the fungus, Mucor; from the body, a delicate thread called the mycelium (*my*), grow erect branches ending in spherical cases, sporangia (*sp*).

a special kind of spore is produced by conjugation, and this is able to resist conditions of drought and cold which would kill one of the ordinary asexual spores. This is a feature common among the Fungi; they produce millions of spores which germinate with great rapidity, and then save themselves by a few of the more resistant kinds. It is this that makes a fungus so troublesome—so rapid in its spreading and so difficult to exterminate.

Like the moulds, the mushrooms (*Agaricus*) have their mycelia entirely in the substratum (humus) on which they live, and their visible part is that devoted to reproduction. This fructification is familiar to everyone: the spores are produced on the *gills* which are to be seen underneath the cap of the mushroom. They are produced,

again in large numbers, without fertilisation ; and in this case no other process of reproduction is known. But the mycelium lives on in the humus, forming along with it the so-called " spawn " of the mushroom.

The parasitic fungi are very numerous. They attack the actual protoplasm of the unfortunate host-plant, penetrating the cells through some chemical property of the tips of their mycelium branches. They are especially partial to the young and active cells. Thus *Pythium* causes the " damping-off " of cress seeds ; mildew attacks the young ovaries of wheat ; ergot similarly corrupts the ears of rye. The action of *Pythium* is easily observed if cress seeds are sown thickly in damp soil in a flower-pot. For a day or two they develop very well ; then they will be seen to be weak at the base of the stem ; and within a week the whole is a dead and rotting mass. Numberless spores are produced asexually, and resting-spores develop by a fertilising process in case of emergency.

Fig. 193.—Lichens are complete organisms composed of a fungus with which unicellular Algæ live in organic association.

An interesting group of plants is the *Lichens*. They are really complex organisms, composed of a fungus with which unicellular Algæ live in organic association or symbiosis. The body of the plant is determined by the fungus, and the algal cells are distributed among the mycelial threads, either more or less uniformly, or in definite layers. The lichens vary in form, from the yellow and grey incrustations formed on old wood, to the large leaf-like bearded lichens found in pine-forests. They thrive in the bleakest situations, forming a thin film of many-tinted vegetation on rocky cliffs which would be otherwise bare.

84. Mosses.—In the mosses we have a higher stage of evolution than the Algæ show in two respects. In the vegetative organs the distinction between leaf and stem is plainly marked, though the leaves are of very simple structure and no vascular tissue is developed in the stem. The reproductive organs are both sexual and asexual, but the two processes occur in a regular alternation, known as the *Alternation of Generations ;* so that the life-history of a moss has, as it were, two chapters in it. The spore is the beginning, and on damp soil develops into a green much-branched filament known as a *protonema*. On this the moss-plants form, while some of its branches act the part of roots and absorb water. The moss-plants produce two kinds of reproductive organs, male and female, on different branches and sometimes on different plants. They are difficult to discover without microscopic aid, and are formed in clusters surrounded by nests of leaves. The

Fig. 194.—Diagram of moss (Polytrichum).

sp = sporogonium ; s = seta ; c = calyptra, or cap.

male cells (*spermatozoids*) are very small and motile, and swim to the larger female cells (*oospheres*), which remain in position on the plant. The result of fertilisation is the sexually-produced spore, known as an *oospore*. This does not develop into a new protonema and moss-plant ; but it produces a characteristic urn-like capsule, the *sporogonium* or moss-capsule, in which a large number of spores are produced without fertilisation ; and it is these spores from which the new protonemas can alone be produced. The sporogonium is usually set up on a long stalk, and is often seen to be protected by a loose cap. Dehiscence of the capsule takes place after this has fallen off. The sporogonium is thus the second generation in the moss's life, existing parasitically on the first.

The mosses are an exceedingly widespread group of plants with very numerous species, inhabiting the most scanty soil, so long as a little water is present. Together with the lichens, they often form the first basis of the soil, by forming the first humus. They spread themselves vegetatively, and the branches often continue to grow after the lower parts and first branches have died away. The whole flora of a bog often rests on the remains of the very characteristic bog-mosses or Sphagnaceæ.

Allied to the mosses are the *Liverworts*, which form a connecting link between them

and the Algæ. Among the liverworts are many thalloid species, e.g. *Marchantia*, very frequent on the damp soil in ditches and woods, and *Pellia*, common by the side of streams. But they show the same alternation of generations as the mosses; and are consequently joined with them in the great group known as *Bryophyta*.

85. Ferns.—The ferns are the leading members of the group *Pteridophyta*, otherwise known as the *Vascular Cryptogams*. They show the same kinds of alternation of sexual and asexual generations as the mosses, but differ from them in the much greater prominence of the latter. The vegetative organs are now completely differentiated, and both

Fig. 195.—Young Fern plant from underside of Prothallus.
p=prothallus; f=fern-plant; r = rootlike fibres from p.

Fig. 197.—Horsetail (*Equisetum*)

stems and leaves have well-defined vascular tissue. Microscopic examination shows that these organs are not so perfectly developed as those of the higher plants; still, they represent an enormous advance on the moss standard. There is nothing yet in the nature of a flower, and of course no seeds are formed. The asexual spores are to be found on the undersides of the leaves or fronds; they are formed in spore-cases (*sporangia*) which are grouped into definite clusters called *sori*. The shape and position of the sorus are characteristic of the species and serve to identify it. When the sporangia open, the sori are like patches of yellowish-brown dust.

A spore will develop in the damp soil, and forms first a little heart-shape green *prothallus*, of about the size of a threepenny piece. Soon will be seen on the prothallus the young leaves of the new fern. But before this, an unseen fertilisation has taken place. The male and female cells are produced in their characteristic organs on the underside of the prothallus. Several of each kind are produced, and can be seen under a good lens, but need the microscope for full examination. Fertilisation goes on as in the moss; an *oospore* is produced, from

Fig. 198.—Club Moss (*Lycopodium clavalum*).

which arises, not a sporogonium, but the fern-plant as we know it, and this, as we have said, bears the unfertilised spores on its fronds.

The ferns have a very varied habit, from small water-plants to large trees in the tropics. The common ferns in England—e.g. Bracken (*Pteris*), Male Fern (*Aspidium*), Hart's Tongue (*Scolopendrium*)—are inhabitants of loose soil generally, especially in woods, though of course bracken is common on heaths and moors. *Polypodium* (Poly-

Fig. 196.—Common British Ferns (from left to right):—Spleenwort (*Asplenium*); Male Fern (*Aspidium*); Bracken (*Pteris*); Hart's Tongue (*Scolopendrium*); Polypody (*Polypodium*).

pody) is often found perched up on trees or rocks, as is *Asplenium* (Spleenwort).

There is nothing at first glance to connect the *Equisetaceæ* (Horsetails) with the ferns ; but they also have the broad pteridophyte characters. Their spores are produced, however, in sporangia which develop only on special leaves, and these are aggregated into cones at the termination of the axes. All the leaves of the Equisetums are much reduced, but those of the cones are hardly to be recognised as leaves. This distinction between the spore-bearing leaves and the ordinary leaves is an important step in advance. The Equisetums are now a small tribe which, like the reptiles among animals, has had a larger place in the world's history than they are now occupying. The fossils of the coal measures reveal the ancient Equisetums as great trees, while now they are but hollow-stemmed inconspicuous companions of the reeds by the waterside or still smaller natives of the light soil of the woods.

Like the Equisetaceæ, the Lycopodiaceæ (Club-Mosses) have fallen from the tree-habit to the status of herbs of a mossy character ; they are distinguishable from mosses by their cones, and are now rare. It is probably through the Lycopods, or some related extinct family, that the line of evolution towards the flowering plant proceeds. The discovery of certain extinct forms which link the pteridophytes to the lowest order of Gymnosperms, or *Cycads*, is one of the most interesting discoveries of late years in Botany. Further study of the Cryptogams demands special work with the microscope, and cannot proceed satisfactorily until the basis of careful general observation has been laid. E. W. E.

ZOOLOGY.—XXXV

THE order *Lepidoptera* which includes the Butterflies and Moths is familiar to a greater or less extent to many thousands of ardent collectors, and is admired the world over by people who have scarcely a nodding acquaintance with any of the species that constitute it.

Butterflies and Moths are amongst the insects which undergo what is termed "complete metamorphosis," that is, each stage by which the perfect insect is developed is sharply defined. We have firstly the egg, secondly the larva or caterpillar, thirdly the pupa or chrysalis, and finally the imago or perfect insect. The egg is deposited upon the plant needed for food by the species concerned, and from it appears the larva with the general appearance of which we are all familiar.

We may point out in passing, however, that caterpillars differ from one another in other respects than their colour. Most species, for instance, have sixteen legs, but some have only ten, and there are other points of difference. The caterpillar is a voracious eater, and as it increases in girth, its skin from time to time becomes too tight for it and is cast off. This process continues until sooner or later the insect merges from the caterpillar to the pupa stage of its career. The transition is abrupt and far-reaching, for the pupa or chrysalis is destitute of organs of sense, nutrition or locomotion. It is, in effect, a case which is attached to some plant stem, and from which issues, after a period varying from a few days in the case of the summer brood to the duration of the winter in normal circumstances, the perfect Butterfly or Moth.

Butterfly and Moth Distinguished

The perfect insect has four wings which are scale-covered, though in a few Moth groups the wings are rudimentary in the females, which in such cases are incapable of flight. The Antennæ are conspicuous both in the Butterfly and the Moth, but whilst in the former these organs are straight and terminate in a thickened knob, in the Moth they are rarely straight and usually taper to a point. This fact makes it easy to distinguish a Butterfly from a Moth. In the antennæ, it is thought, are situated the organs of touch, hearing and smell. All Butterflies and some Moths are day fliers, the former being purely creatures of the sunshine, but the majority of the Moths fly after dusk.

No other insect can vie with the Butterfly and the Moth in magnificence of colouring. But what is more fascinating even than the artistic beauty of the individual Butterfly is the purpose that beauty serves. Unfortunately this aspect of the question is too frequently overlooked. A Butterfly in the common regard is associated with everything that is light and unnecessary; we think of it as a feather-brained creature arrayed in sumptuous but unnecessary beauty. Such an opinion, however, is entirely unjust, for the form and colour of these insects in every case serve a definite purpose. Vary them, and the dangers which always surround the Butterfly will become so overwhelming as to make its death within a short time a practical certainty.

This is notably the case with certain

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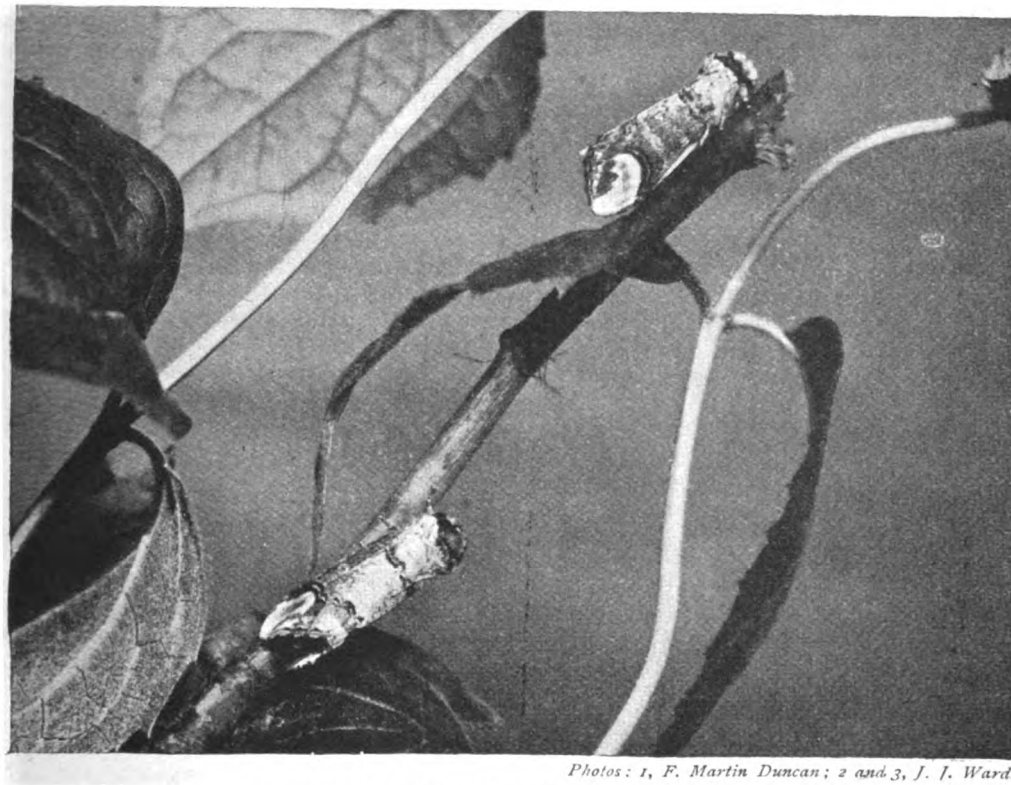


3

Photos: 1, F. Martin Duncan; 2 and 3, J. J. Ward.

PROTECTIVE COLOURING AND MIMICRY.

1. The Indian Leaf butterfly is almost indistinguishable from the shrivelled leaves among which it reposes; 2. the Poplar Hawk moth which when resting on a poplar tree looks very much like a dead leaf attached to the bark; 3. a pair of Buff-tip moths resting, showing their remarkable resemblance to bits of broken stick.

species which are protected by a nauseous taste or smell, for insect-eating birds and lizards recognising the wing markings leave these unpalatable creatures alone. Such colours have been aptly named "Warning Colours." Here then is an instance of beauty serving a definite end. Unmarked by these distinctive colours, the hungry bird of necessity would kill the Butterfly before he discovered that the dish was not to his taste.

Life Assurance in Form and Colour

But the immunity of attack thus secured by some unpalatable species has led to a most extraordinary development in the case of some others which cannot put forward a similar claim for exemption. In these cases the insect actually mimics the Warning Colours of undesirable Butterflies frequenting the neighbourhood, and so, as often as not, escapes. Mimicry of this description is most frequent in the female insect, probably because being slower on the wing than the male she runs a greater risk of capture.

But the possessors of Warning Colours and their Mimickers form but a portion of the fifty thousand or so known species of Butterflies and Moths; and the question arises, How do those feeble and apparently slow insects which are not so guarded effect their escape? Again the answer is found in form and colour. Dealing still with the latter, it is more than probable that some of the most beautiful markings have no other purpose than to attract the attack of a pursuer away from a vital spot. Were he to strike at the body the career of the Butterfly would be at an end, but the wings may be torn without incapacitating the insect, which thus secures a brief moment in which to save itself.

Protective colouring, it should be noticed, is usually twofold. As everybody is aware, the under-side of the wing may appear dull when compared with the upper. This is explained by the fact that the under-side commonly harmonises with the surface upon which the species habitually rests. When in repose the Butterfly or Moth holds its wings upwards, displaying only those sides which are practically indistinguishable from their surroundings. It is this marvellous facility for blending itself with its environment that accounts for the complete disappearance of the Butterfly in dull weather.

What is probably the most pronounced example of protective resemblance in the animal world is afforded by the Malayan Leaf Butterfly and the kindred Indian species *Kallima inachis*. These insects combine form and colour in so marvellous a fashion that they are indistinguishable from the shrivelled and decaying leaves amongst which they repose.

Another class of marking present in many species of Butterflies and Moths is not specifically designed for protection, but owes its origin to Sexual Selection, or, in other words, to choice on the part of the female insect. The relationship borne by Sexual Selection to Natural Selection is thus happily figured by Mr. Poulton. "Natural Selection is a qualifying examination which must be passed by all candidates for honours; Sexual Selection is an honours examination, in which many who have passed the previous examination will be rejected."

But though the female may exercise a preference for a male carrying certain markings, it is clear that the perpetuation of these colours must ultimately depend upon the extent to which they lend themselves to defence. For however fascinating a gaily-coloured insect may be to the females of its species, if its distinctive characteristics attract its enemies and hamper its defence, the extermination of the type is certain. Colour markings in insects, therefore, tend to perpetuate themselves in this fashion, that firstly those colours survive, and in the course of time become accentuated, which in any way assist in the preservation of the species, and secondly other markings are added when they are attractive to the females of the species without being detrimental to the safety of the wearer.

The Larva's Ruses

As we have seen, life is a possibility for countless numbers of Butterflies and Moths only upon the assumption that their enemies will not take them for what they are. But this statement is increasingly true when we apply it to the larval stage of their lives. As winged insects they possess at least a certain facility of movement, but as caterpillars they can neither defend themselves nor take safety in flight.

A hundred different species seek safety in one hundred different fashions, each more astonishing than the last. The caterpillar of the Swallow-Tail Moth disguises itself as a twig; the large green pupa of the Purple Emperor Butterfly appears to be a leaf; the chrysalis of the Red Admiral Butterfly resembles the surface of the rock upon which

LEPIDOPTERA.

1, *A beautiful butterfly from S. America, of the genus,* Morpho; 2, *Swallow-tail* (Papilio machaon); 3, *Peacock* (Vanessa io); 4, *Chalk Hill Blue* (Polyommatus corydon); 5, *Common Blue* (Polyommatus icarus); 6, *Red Underwing* (Catocala nupta); 7, *Cream Tiger* (Arctia villica); 8, *Burnet Moth* (Antrocera filipendulæ); 9, *Merveil du Jour* (Diphthera orion); 10, *Front and side views of pupa of Tortoiseshell* (Vanessa urticae); 11, *Caterpillar of Puss Moth* (Cerura vinula); 12, *Caterpillar of Vapourer Moth* (Orgyia antiqua).

it pupates; the caterpillar of the Puss Moth withdraws its head into the first ring of its body, inflates its skin, causing two large body spots to resemble enormous eyes, and thus hides its utter insignificance beneath a terrifying aspect.

The *Danaidæ* constitute a well-known group of Butterflies confined largely to the tropics. The insect has large broad wings, and is generally either of a warm reddish tawny colour, with blackish borders, or brownish-black, the centre of the wings being green. The only European species is found in Greece. The *Danaidæ* are unpalatable to insect-eating birds, and for this reason are largely immune from attack. Their markings are mimicked by several species of butterfly, which thus bear a much closer resemblance to the *Danaidæ* than to their own allies.

Admirals and Fritillaries

The Chrysippus, which is the Grecian species just alluded to, exhales an unpleasant odour when attacked. An allied American species called the Monarch is sometimes five inches from tip to tip of the extended wings. This insect has been captured in England, though the species is not acclimatised here. The White Admiral is now scarce in England where it is found in isolated woodland districts.

The Purple Emperor is generally recognised as one of the finest British Butterflies. Its extended wings sometimes measure three inches across, and it may often be seen soaring at a great height above the ground.

The Red Admiral is one of the commonest of our British species. It frequents gardens and hedgerows, and may often be seen settling on fallen fruit. This butterfly is met with most often towards the close of the summer. The Camberwell Beauty is a rare butterfly of handsome appearance.

The Fritillaries include three groups known as the Chequered, Small Silver-spotted and Large Silver-marked Fritillaries. In the first-mentioned group occur three English species, one of which, the Greasy Fritillary (*Melitæ Aurinia*) can be distinguished by the alternation of pale and dark spots on its upper surface, and by the appearance of the under surface which has procured for this insect its unattractive name. The Glanville Fritillary is distinguished by black spots beneath the hind wings towards their base. This butterfly is now extremely rare in England. The Pearl-Bordered Likeness Fritillary is tessellated with black and tawny above, and with yellow and tawny below.

The English Fritillaries frequent waste places in the spring of the year. The smaller Silver-Spotted Fritillaries include two British specimens, the Pearl-Bordered Fritillary and the small species of the same name. The third group mentioned above has the distinction of including the largest Fritillary found in England, the handsome Silver-washed Fritillary. A familiar British butterfly, common during June and July, is the Meadow Brown, which is found in open spaces over grass.

Swallowtails; White, Yellow, and Blue

The Swallowtails derive their name from the appendages to their hind wings. There are about five hundred species known at present, but only four are European. Most of them have a powerful flight and are difficult to capture. The *Papilio Machaon* is the most common of the European species, and the only one found in England. It is a sulphur-yellow butterfly, with black markings and borders to the fore wings. The hind wings are tailed, and their dark border encloses a row of large blue spots. A red spot is found at the anal angle.

The White and Yellow Butterflies include several of the species most injurious to farmers. The white varieties may be distinguished from the Swallow-Tails by the difference in shape of the inner margin of the hind wings which is not concave. The Clouded Yellow Butterflies include the brightly-coloured *Colias Edusa*, which is generally found in clover fields in the autumn. The pale Clouded-Yellow is less common. The Orange Tip is a pretty spring butterfly found in woods and meadows in April and May. The White Wood has long, narrow wings marked with an ashy spot at the tip of the fore wings.

The Blue Butterflies which are numerous on the Continent are represented in England by a dozen species. In most cases the male only is blue, the female having a brownish tint. The Common Blue is seen in great numbers during the summer. The male is blue above with white borders upon the inner side of which runs a thin black line. The under-side carries black spots enclosed in white rings and marginal red spots. The female is darker, more or less blue above, and with red spots upon the upper surface.

A group of butterflies which is considered to resemble the Moth more than some other species is termed the Skippers.

In these species the flight is rapid and jerky. The Pearl Skipper is a well-known British species common in certain dry localities.

The Moths are far more numerous than the Butterflies though they have received somewhat less attention at the hands either of collectors or entomologists. Throughout the world there are between 40,000 and 50,000 species of moths to 10,000 or 12,000 species of butterflies, the proportion of species in Britain is about 30 to 1.

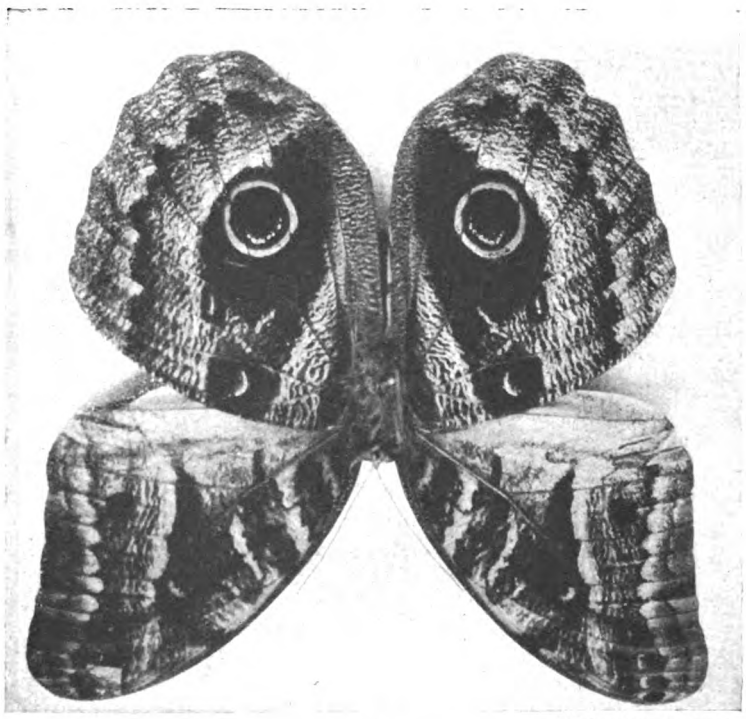


Photo: Harold Bastin.

THE OWL BUTTERFLY.

The eye spots are protective; they play the part of a bull's-eye on a target and so serve to guard vital parts of the insect's body.

The Hawk-Moths, which are usually grouped apart from the true moths, may be known by their large heads, prominent eyes, stout antennæ, more or less thickened at the middle and often serrated, and their long, narrow and pointed wings.

The Death's Head is the largest of all British butterflies and moths. It has a wide range, being met with in Europe, Africa and Asia. The fore wings are dark-brown, varied with black, grey and yellow, and the hind wings are dark yellow with two black bands. The name Death's Head, as most people are aware, is gained from the marking on the back of the thorax which is not unlike a skull. The large yellow-green caterpillar with wide and prominent bands feeds upon various plants including the potato. It is this moth which is addicted to entering the hive and feeding upon the honey when, it is suggested, its peculiar noise resembling the note of the Queen Bee secures it immunity from attack.

The Elephant Hawk Moth is fairly common in this country. It gains its name from the appearance of the larva which tapers towards the head, so that when viewed from a distance, a body mark appears to be an eye, and the front part of the body to be a prolonged snout. The Humming Bird Hawk Moth so nearly resembles the bird after which it is named that, when seen upon the wing in countries in which both bird and insect are to be met with, it is often impossible to tell which is which.

The Clear-Wings are a small family containing a few moths with transparent wings. The largest of these species, the Hornet Clear-Wing, is exceedingly interesting inasmuch as it so closely resembles a wasp that very few people can tell the one from the other. It is quite a harmless insect. The wings of the Currant Clear-Wing carry black borders slightly varied with orange. This is the most common species of Clear-Wing in England.

The Foresters and Burnets, which are classed with the foregoing species amongst the Hawk Moths, are small insects with stout bodies, long fore wings and shorter hind wings. Most of the species may be seen flying over meadow land by day. The Foresters have green fore wings and brown hind wings. The Burnets are conspicuous insects with diurnal habits. The fore-wings are steel-blue or greenish, spotted or streaked with bright red; the hind wings are of the same colour. The red markings of this insect are occasionally replaced by yellow.

The Tiger Moths have the fortunate reputation of being the most beautiful

Photo: H. Bastin.

DEATH'S HEAD MOTH

in flight. This moth—the largest of all British butterflies and moths—gained its name from the marking on the back of the thorax, which is not unlike a skull.

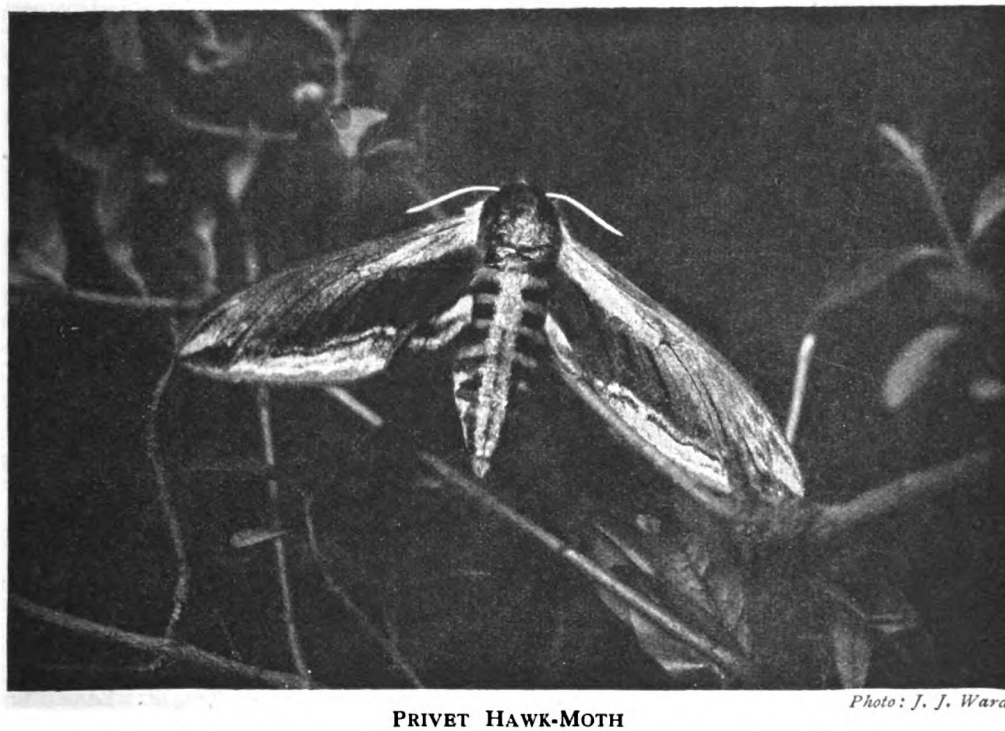


Photo: J. J. Ward.

PRIVET HAWK-MOTH

resting, with wings partly expanded. The plump, brightly tinted larva of this moth is left severely alone by insect-eating birds: a marked case of warning colours.

family of moths found in Europe. The Common Tiger Moth may be taken as typical of this group. It measures from two to three inches across the wings, which are black with interlacing white markings, the hind-wings are red with large black spots, bordered with yellow. This insect feeds on lettuce and a variety of other plants.

The Goat Moth is a common insect in England. It measures three inches or more across the wings, and is a heavy-looking moth shaded with grey and brown. The larva lives for three years, burrowing in the wood of willows, poplars and other trees before it turns into a pupa. The Kentish Glory is a large handsome Moth, common in birch forests in England and Scotland. It is closely allied to the Chinese Mulberry Silkworm (*Bombyx mori*).

Silkworms: Chinese and British

The larva of the latter is a creamy-white and carries a hump on the last segment but one of its body. In England this insect frequently feeds on lettuce. The Chinese, it may be noticed, attribute the use of silk to the Queen of the Emperor Hwang-té, who lived about 2640 B.C. The moth has wings of a yellow-white colour with dusky but indistinct transverse lines. It is not reared in England for commercial purposes, and such silk as is secured from it in this country has little commercial value.

Much of the silk produced in China, India and Japan is produced by large moths of the family *Saturniidæ*, of which the Emperor Moth is the only British representative. This moth is to be found in numbers on heaths and in bushy places. It measures between two and three inches across the wings.

The Lappet Moth of the family *Lasiocampidæ* may be known by its reddish-brown dentated wings, marked with zigzag transverse lines. The Oak Eggar is common in woods and heaths. The male is chestnut-brown, and the female ochre-yellow; across the wings runs a broad transverse band of pale yellow. Both sexes carry a white spot in the middle of the fore-wings. The male is a day flier and travels more quickly than any other British moth.

The Buff-Tip of the family *Notodontidæ* is a destructive insect living on the leaves of trees. It frequently escapes recognition from its habit of wrapping its wings round its body in such a fashion as to resemble a small piece of dry moss-covered stick.

The Owl Moths or Night-Flying Moths are a large group of insects of moderate size and generally of dull colours. These are the moths which during the summer enter the open window after lamps have been lighted, and probably they are considered by most people to be typical of all moths, which, of course, they are not. Even amongst the Owl Moths some species, as a matter of fact, are day fliers of bright colours. In England alone some three hundred different species of Owl Moths may be collected. The Heart and Dart Moth is a typical representative of this group, and is common in England. The larva of this insect feeds on the roots of grass and on various low plants, and is very destructive.

Meal Moth, Looper and Pug

The Loopers or Geometers are a large group which gain their name from the fact that the larva loops its body when progressing. This is caused by the absence of the two first pairs of prolegs. The legs have doubtless been dispensed with in order to assist the insect in maintaining its disguise as a twig. The moths are generally broad-winged with slender bodies. They fly at dusk and during the day shelter in hedges whence they can readily be driven by the simple expedient of beating the hedge.

The Swallow-Tail Moth is the largest European species belonging to the Loopers, and is common in England and Ireland. It may be seen in July during the evening, flying along bushes and hedges. The Chimney Sweep is a common species in England of a complexion in keeping with its name. It prefers hilly country and is a day flier.

The Netted Pug is representative of the large genus known as the "Pugs." This insect may be found flying over the flowers of different species of Campion and Catchfly in the evening. A few species of the Pugs are more or less white or green, but the majority are of a drab or brownish tint.

Moths belonging to the family *Pyralidæ* are small with longish wings and long, slender bodies; the Meal Moth is, perhaps, the best known. This insect measures about an inch across the fore-wings, and is common over a great part of the world. The Knot Horns and Grass Moths are small insects in which the fore-wings are long and narrow, and the hind-wings broad and rounded. The Knot Horns are mostly inconspicuous dull brown or greyish insects; the Grass Moths generally have brown or straw-coloured fore-wings intersected by a white or silvery longitudinal streak.

The Bell Moths may be known by their broad, truncated fore-wings which meet

together over the back and, to the fanciful, give the insect the shape of a bell. Several species are destructive to fruit or forest trees. The Green Oak Moth is the commonest and most destructive of this group. It measures nearly an inch across the fore wings, which are green. The hind wings are brown.

The *Tineæ* are a numerous family of small moths amongst which occur the dreaded and detested Clothes Moth. Many of the species represented in the *Tineæ* feed on cloth, fur, feathers, horsehair and other animal products, and may be found in houses throughout the year. The original Clothes Moth is dark grey, with three brown spots on each of the fore wings. Amongst the many destructive species allied to the Clothes Moth is the Small Ermine, which is very destructive to hawthorn, apple and other trees.

The Plume Moths may be known from all other moths by their wings which are formed of distinct "feathers." The only British representative of the family, the Twenty Plume Moth, is usually grey in colour, and seldom reaches three-quarters of an inch over the expanded wings. Each wing is split into six separate plumes or feathers. A. B.

METEOROLOGY.—VII

THE co-operative nature of meteorological work has been emphasised, and now we have to note the chief fruits of such co-operation. The co-operation itself is brought about by the work of observatories, stations other than observatories, and a host of private investigators. The chief observatory in the British Isles is that at Kew. Here research work on various meteorological questions is carried on and instruments are standardised. Other important observatories are situated at Valencia in the far west of Ireland, Aberdeen, where the institution is connected with the University, Falmouth, Eskdale, and Benson in Oxfordshire. The Eskdale institution is noted for its work on terrestrial magnetism and atmospheric electricity. The Benson Observatory is mainly concerned with the investigation of the properties of the upper air, and in this respect a Meteorological Office situated at Farnborough is similar.

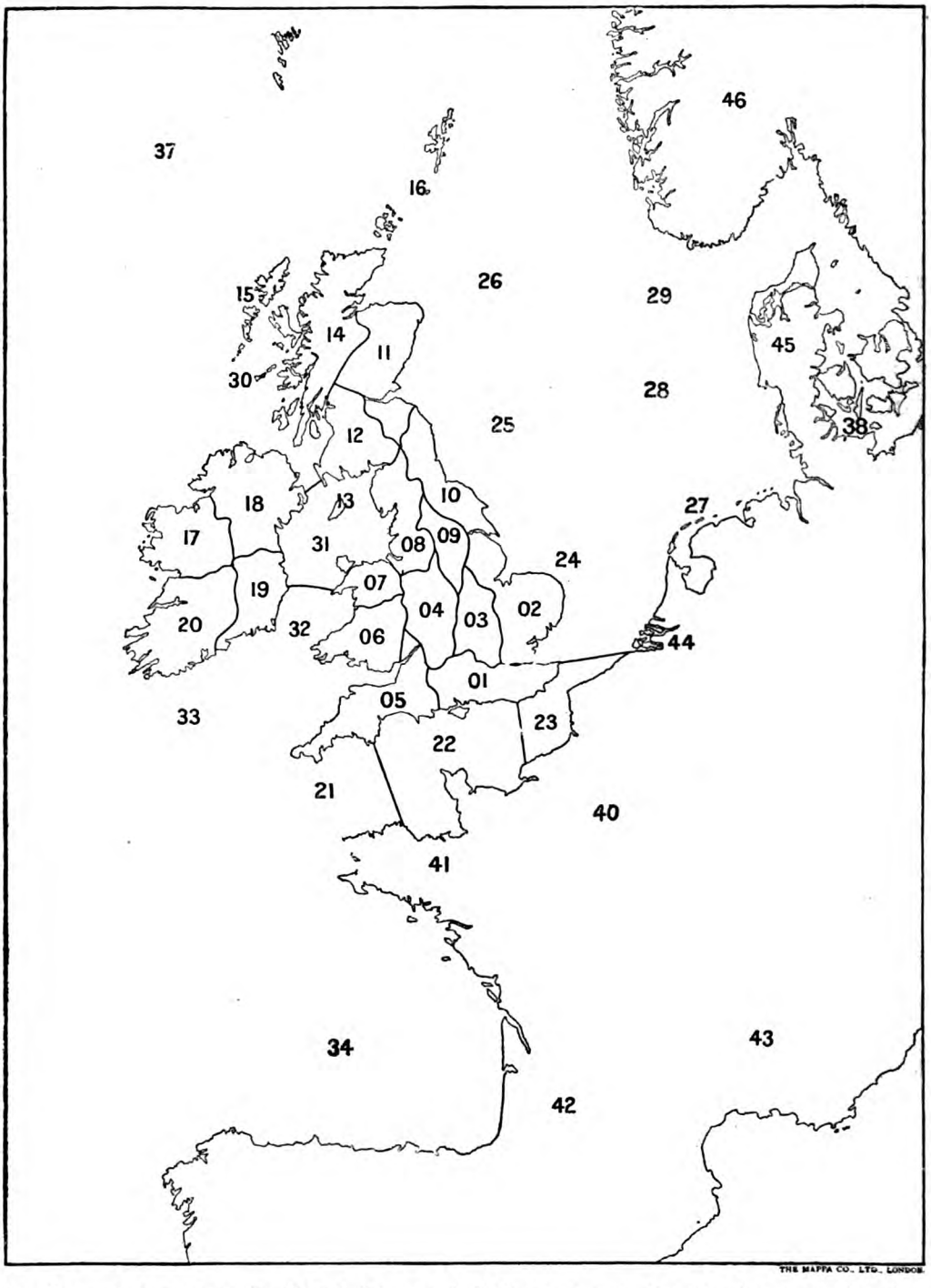
Observations on the upper air are necessary to aviation, and a separate series of reports and forecasts are issued in connection with this phase of the subject. Falmouth on account of its south-westerly position renders most valuable service in connection with ordinary weather reports, i.e., with the state of the atmosphere situated near the ground. The community at large is more concerned with these ground phenomena than with the properties of air at higher altitudes.

In addition to these first-grade observatories there is a large number of meteorological stations supplying information to the office in London. These stations vary in standing according to the fullness of the records kept by them. The more important are: (a) *Normal meteorological observatories*, or stations of the first order, where continuous records are made; (b) *Normal climatological stations*, or stations of the second order, where observations are made at 9 a.m. and 9 p.m. and in some cases also at 3 o'clock in the afternoon; (c) *Telegraphic reporting stations*, of which there are twenty-four in number. These telegraph information about the pressures, temperatures, etc., to the London Office each morning at seven, afternoon at one, and evening at six.

Upper Air Records

In order that all such stations should telegraph at precisely the same time, no matter what their longitude may be, *Greenwich Mean Time* (G.M.T.) is employed. There are many stations sending less detailed information and such are known as *auxiliary* and *additional* stations. Finally there are special kite and balloon stations, such as that at Farnborough, which prepare records of the upper air. For the benefit of any reader who might feel disposed to attempt work on the lines of a Normal Climatological station, it may be said that the necessary apparatus can be obtained for a sum of about £20. The instruments required include a mercury barometer, dry and wet bulb thermometers, maximum and minimum thermometers, a rain gauge, sunshine recorder, solar radiation thermometer and earth thermometer. It must be borne in mind, however, that a suitable site for the apparatus is absolutely essential and it is this item that is usually a serious drawback to the lay investigator.

The work of the Meteorological Office does not merely consist of making forecasts, but embraces many other things such as the preparation of daily, monthly and annual reports referring to weather experience over large areas including the oceans. On p. 266 an Atlantic Wind Chart was given.



For forecasting purposes the British Isles are divided into twenty districts, shown on the above map, which also gives the numbers of districts in the seas and countries of W. Europe. In return for a small registration fee and the cost of telegrams the Meteorological Office will send forecasts direct to individuals (*see* p. 399).

Forecasts are of great use to farmers, mariners and aviators. By payment of a small registration fee and the cost of telegrams farmers can have forecasts for their districts forwarded by the Central Office. This arrangement is particularly useful during the harvest season for obvious reasons; also spells of fine or wet weather may be notified in like manner. It is worthy of note that less than 5 per cent. of the Meteorological Office forecasts contain any inaccuracies.

Weather Forecasts

For forecasting purposes the British Isles are divided up into twenty districts shown on the map on page 398, on which are also shown the numbers of districts embracing the seas and countries in the W. and N.W. of Europe. The necessary information is received by telegraph or wireless from seventy-five continental stations besides those in Great Britain mentioned above. (For map refer to Vol. V, p. 266.)

It is of the utmost importance that all stations, continental and otherwise, forward their reports at the same time ; consequently the messages are sent twice daily at seven in the morning and six in the evening G.M.T. The evening hour is generally expressed as 18 h., according to the military method of stating the time. Two hours after receiving the information, the Meteorological Office has constructed the necessary maps and prepared the forecasts, for the various districts. The forecast is a statement of weather conditions that are likely to exist for at least twenty-eight hours from the time at which the office received telegraphic information. Experts are employed in drawing up these reports and forecasts, and the amateur can hardly expect to exhibit such skill in interpreting weather phenomena ; but a general idea of the methods employed may be obtained from the perusal of maps.

The student should consult the charts in Vol. II, pp. 290, 292, together with those on pp. 400 and 401 of this volume. It must be clearly understood that the issue of a forecast is possible as the result of careful study of the *arrangement of air pressures over large areas and the direction in which such arrangements move*. Occasionally isobars appear to be simply straight lines, but more often they take the form of curves, and such curves show various arrangements associated with weather characteristic of each.

A common arrangement is a *Cyclone*, which consists of a low pressure area surrounded by districts in which the pressure increases outwards. This class of cyclone must carefully be distinguished from the tropical revolving cyclone of the Indian Ocean.

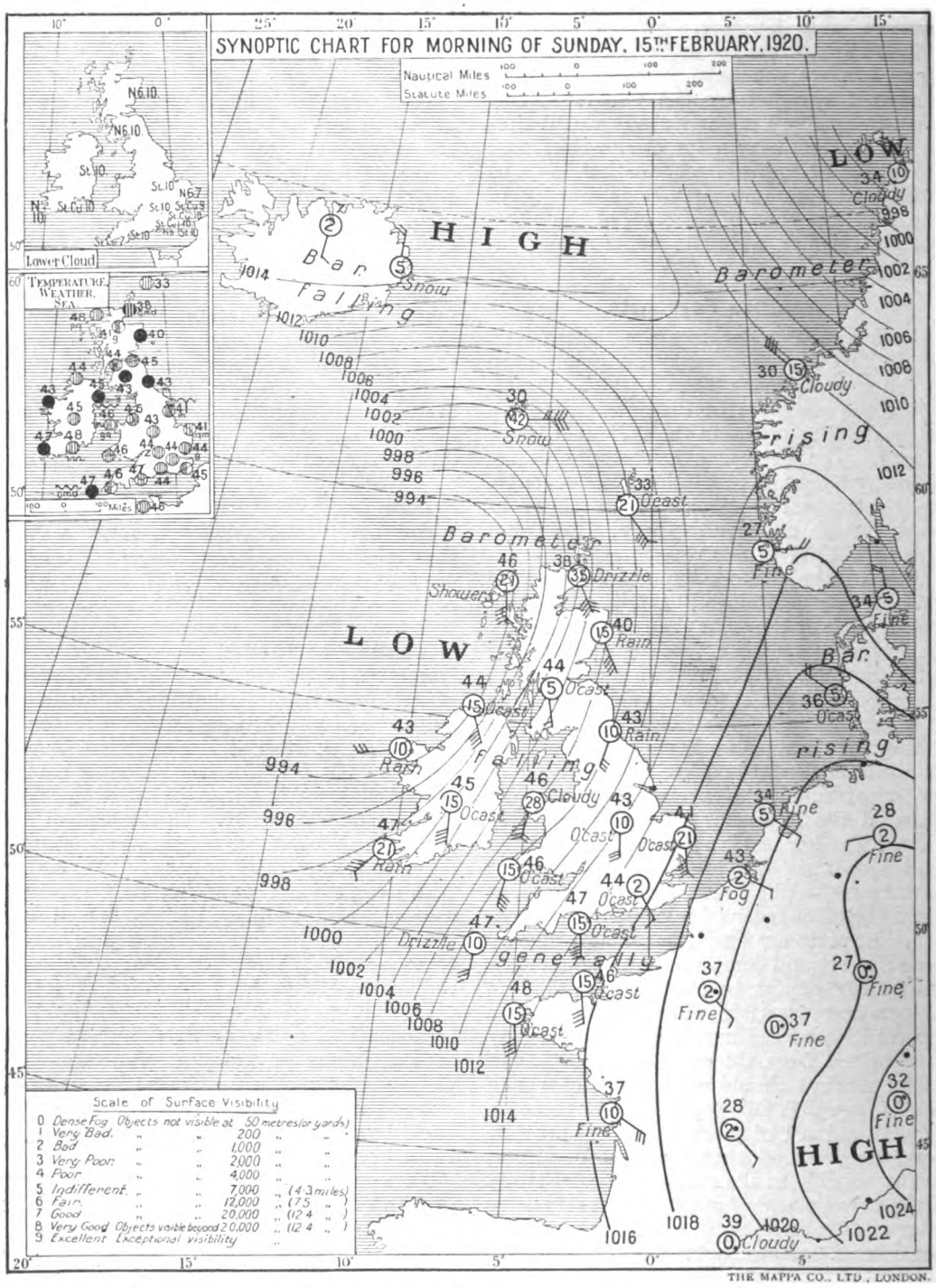
Now the cyclonic arrangement of air pressures moves in these latitudes towards the north-east, and carries a definite and characteristic type of weather with it. Districts in the path along which the arrangement is about to travel may expect the usual cyclonic weather in a short time. As this weather is well indicated in the chart, Vol. II, p. 292, little more need be said here. But it might be noted that the front portion of the arrangement has less steep gradients than the rear end, consequently the winds occurring after the low pressure has passed are stronger than those with which it was ushered in. Lunar halos are often seen during the earlier period of the cyclone.

The Anti-Cyclone

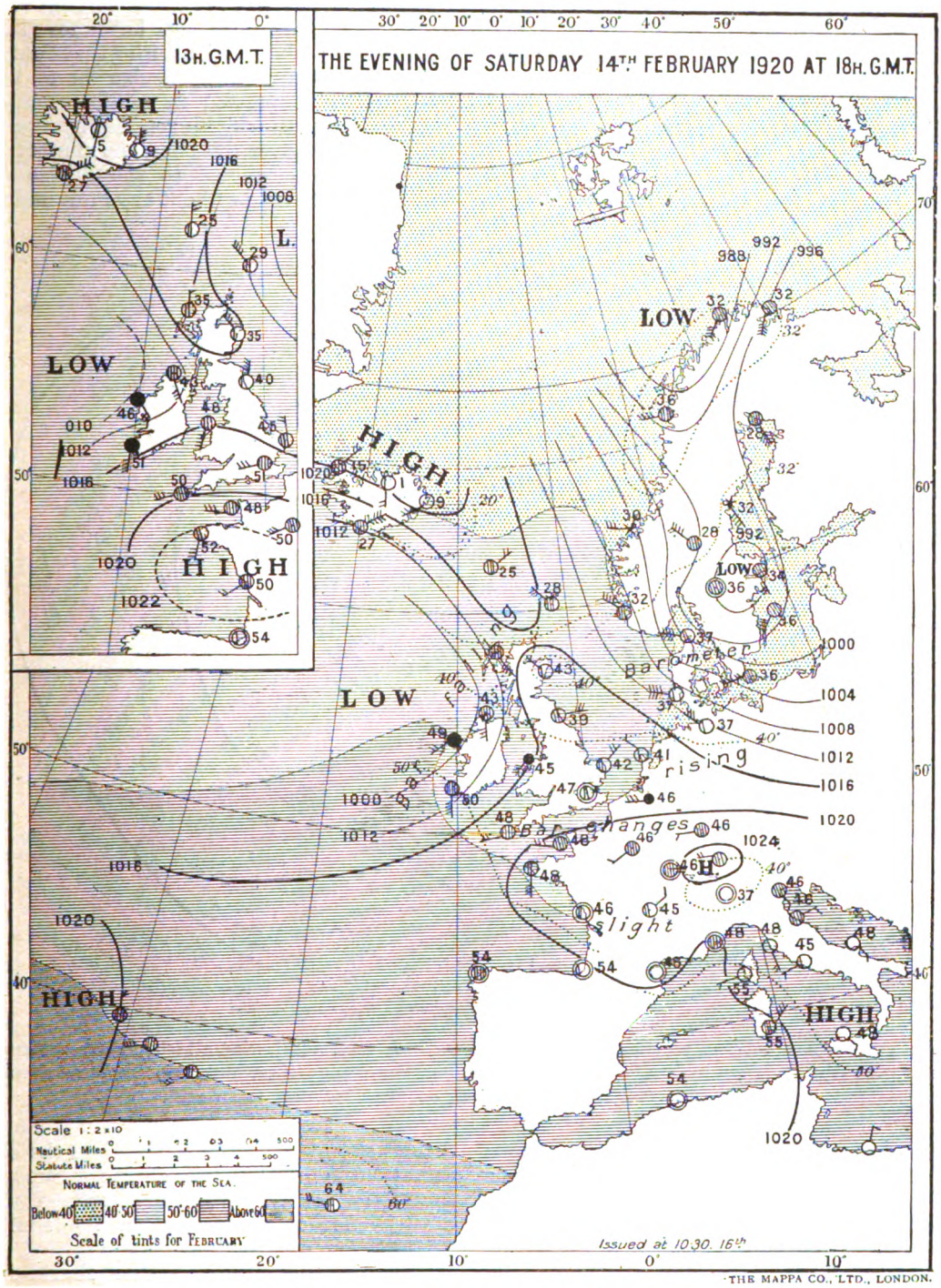
Another arrangement less common than the cyclone is the *Anti-cyclone*, which consists of a curved arrangement of air pressures having a high pressure centre and decreasing pressure outwards. These arrangements also move from south-west to north-east in the North temperate zone, so that the approach of an anti-cyclone condition indicates the existence of fine weather in the near future. The winds of such an arrangement blow in the same direction as the hands of a clock and their force is not great since the barometric gradient is low. In the central area clouds are rare, hence occurs what is known as *radiation weather*, embracing a clear sky with a high temperature during the day and a deposit of dew during the night in summer time. In winter frost is deposited because there are no clouds to prevent excessive radiation of heat from the earth at night.

In the outer portions of the anti-cyclonic arrangement any clouds that exist are either of the cirrus or cumulus varieties. The passage of the whole arrangement is much slower than that of a cyclone, consequently, typical radiation weather may last for some time, even several weeks.

There are other arrangements of air pressures which may be diagrammatically represented by isobars of different shapes. Of these a complication occurring in a cyclone and known as a *Secondary* may take place. Such a secondary is really a small curved barometric depression formed usually at the rear edge of the cyclone, and as this secondary passes over any place it brings a large amount of rain to that locality. Secondaries are certainly the rainiest portions



The reader who wishes to study the weather closely and to make attempts at forecasting likely conditions in the near future will find it very instructive if he makes a tracing of to-day's weather chart and superimposes it on

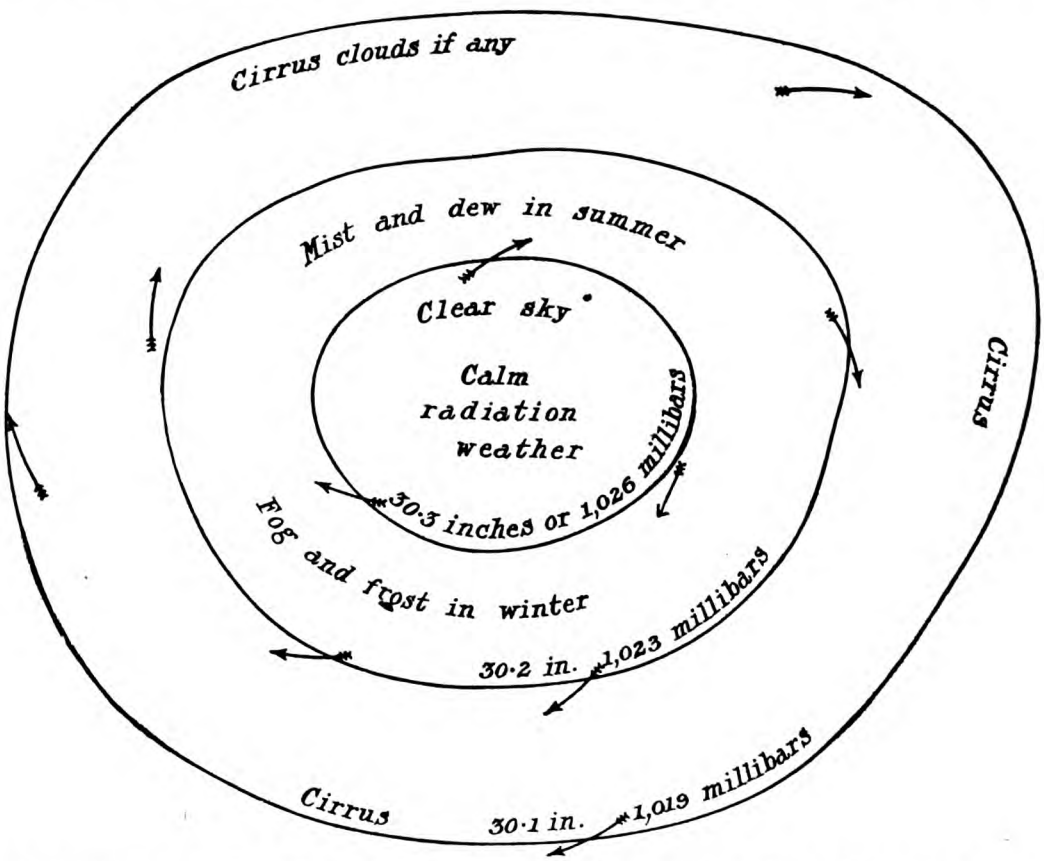


——the weather chart of yesterday. By this means he can note the direction in which the air pressure system has moved during the last twenty-four hours, and gain some idea of the movement probable in the near future. The charts on this page and Vol. II., pp. 290, 292, will serve admirably for practice purposes.

of the cyclonic system of which they form a part.

Sometimes there exists between two anti-cyclones an area of low pressure. Such is called a *Col* and is in atmospheric phenomena what a mountain pass is in physical geography. The weather accompanying the passage of a col is naturally not so fine as that of the anti-cyclone. There are at least two other

It will be seen that the whole of the barometric pressure arrangements have moved in this north-easterly direction during the twenty-four hours. On these particular charts, the pressures are expressed in millibars only, and the state of the sky is expressed by means of circles having vertical lines, the number of lines being proportional to the degree of cloudiness. A circle without any lines means



An anti-cyclone consists of a curved arrangement of air pressures having a high pressure centre and decreasing pressure outwards. In the North temperate zone these arrangements move from South-West to North-East, and their approach indicates fine weather.

asobaric arrangements, one of which is known as a *V-shaped depression* and the other is called a *Wedge*. The V-depression has the lower pressures inside and corresponds to a valley in topography, whereas the wedge is somewhat similar to the spur of a mountain.

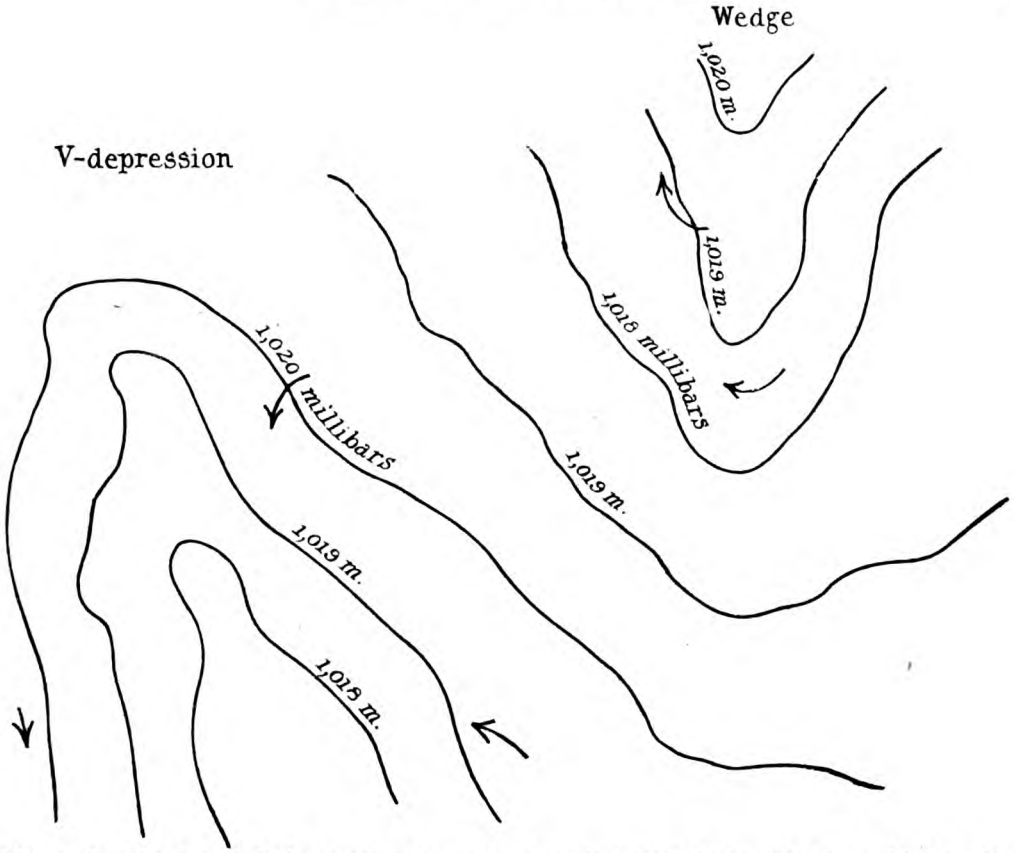
The weather charts given for North-West Europe show the general weather conditions for two consecutive days.

Two adjacent wedges are shown in the region of N.E. Scotland on the Saturday, and by Sunday these wedges have passed forward N.E. to Denmark and Norway.

a clear sky at the place at the time the observation was made. The chart for Sunday shows the comparatively large size of the anti-cyclonic arrangement over the south-east portion of the area.

The construction of weather charts for N.W. Europe is of some difficulty on account of the general absence of stations in the Atlantic region, though considerable help in this direction is now obtained by wireless messages from ships.

At this stage, with the charts in front of us, it may be perhaps the best moment to



Illustrating the two isobaric arrangements termed a V-shaped Depression and a Wedge. The V-Depression corresponds to a valley in topography; the Wedge to the spur of a mountain.

introduce what is known as the *Law of Buys-Ballot*—so called from the Dutch professor who first formulated it. Simply stated, this law declares that *if you stand with your back to the wind the low pressure area will be on your left hand.* Reference to any of the diagrams given will show that this rule holds good in all cases. Of course in the Southern hemisphere the law holds good provided right hand is substituted for left. It should be borne in mind that the direction of winds and the passage of barometric arrangements is different south of the equator from the corresponding motions in the northern hemisphere. Thus cyclones and anti-cyclones move from north-west to south-east over Australia and New Zealand.

The reader who wishes to study the weather closely, and to make attempts at forecasting likely conditions in the near future, will find it very instructive if he makes a tracing of to-day's weather chart and superimposes it on the weather chart of yesterday, being careful to see that he places the tracing of the coast and towns, etc., over the corresponding positions of the map underneath. By this means he can note the direction in which the whole air pressure system has moved during the last twenty-four hours, and gain some idea of the motion of the arrangement likely to take place during the lapse of another twenty-four hours.

On pp. 400, 401 are given two specimen maps which will serve the student admirably for practice purposes.

It has been mentioned before that a high barometer does not always mean fine weather, and a low barometer wet weather, but these relations usually hold good, hence a rough forecast of likely weather may be made from observation of the barometer alone. Admiral FitzRoy's barometric guides to the weather may be briefly summarised by saying that the mercury rises for cold, dry, or less wind; and falls for warm, wet, or more wind.

This generalisation applies to places of any latitude.

In our own latitude the "weather guide" is a little more explicit, since a rise in the barometer usually indicates, for us, a northerly or north-west wind, whereas a fall in the barometer usually indicates a southerly

or south-west wind. These facts are, of course, connected with the Law of Buys Ballot.

Another important connection between the reading of the barometer and weather changes is the *rate* at which the mercury falls. A rapid descent of the mercury indicates a steep barometric gradient and consequently indicates stronger winds. Another "rule" formulated by Admiral Fitzroy in the lines

"First rise after low
Foretells stronger blow"

has been found to be correct generally. Rapid rise or fall of the barometer usually indicates unsettled weather, while more stable weather conditions are generally accompanied by slower changes of the mercury.

The reports on the state of the upper atmosphere are published separately as a supplement to the ordinary report of weather near the ground. We give here a set of maps from such a supplement, and it will be noted that the maps represent winds, clouds, etc., occurring at different levels expressed in thousands of feet. An upper air forecast simply states the nature of winds that may be experienced at different altitudes. This branch of the work developed rapidly during the World War. L. M. P.

ANATOMY AND PHYSIOLOGY.—XIX

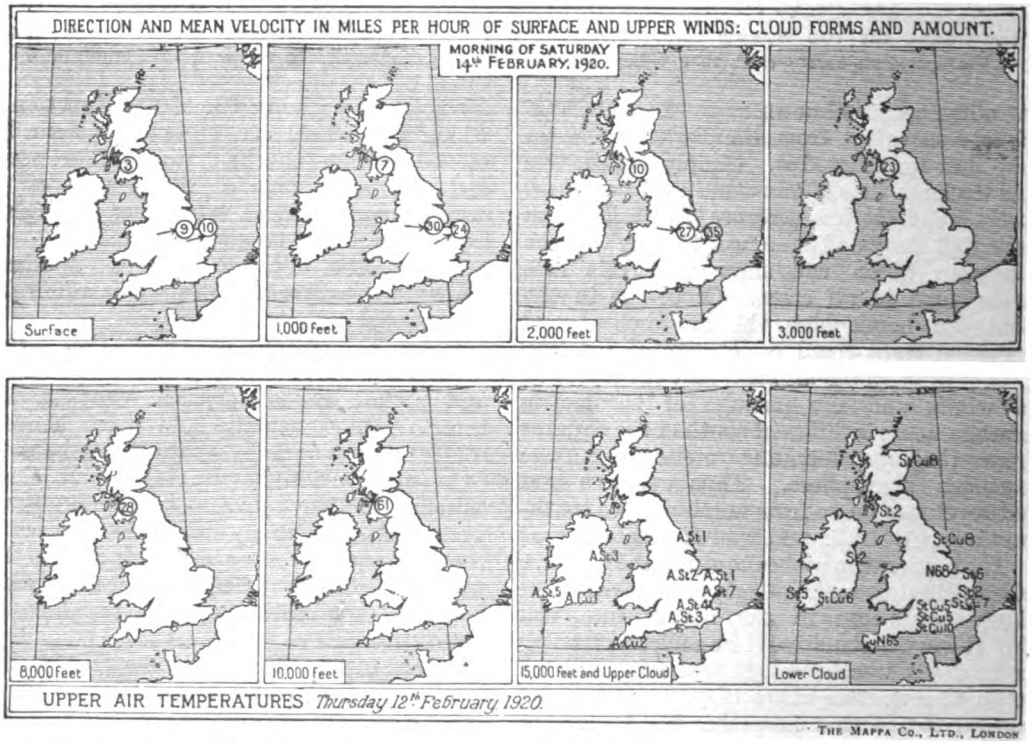
WHAT is the object of this power of adaptation to surroundings that we have been studying? Why is there this elaborate series of mechanisms whereby we become aware of our surroundings, and are enabled to seize what is of advantage to us, and avoid what is harmful?

The object is that we may keep alive.

Self-preservation is the first instinct of every animal, and these are the means by which we obey this instinct. Most of the work which the human machine does, under natural conditions is done to keep the body alive.

And yet in the long run, this attempt is a failure, in the end we all of us die, no matter how hard we try to keep alive. We must believe that our instinct for preserving our own lives is part of a greater scheme for the preservation of the race, and the preservation of the race is effectively secured by our instinct for self-reproduction. Every natural animal desires to preserve itself and to reproduce its species.

In the unicellular animals, such as the *amœba* described in Vol. III, p. 474, repro-



Specimen reports on the state of the upper atmosphere. Such reports are published as supplements to the ordinary reports, and show winds, clouds, etc., occurring at different levels.

duction is a simple enough affair. When the *amœba* grows to a certain size, it divides into two, and then there are two *amœbæ* where previously there was one.

In the higher animals in general, and the vertebrates in particular, the matter is specialised, and particular cells of particular organs are set apart for the function of reproduction.

The reproductive organs consist of the special or essential glands containing the reproductive cells proper, and of additional or accessory organs for the disposal of the reproductive cells.

The essential female reproductive organ is the ovary, whose cells are ova, or eggs: the male organ is the testis, a gland which secretes what are known as spermatozoa. The union of the two cells is called impregnation, or fertilisation, and the new cell so formed is called a fertilised ovum.

In birds the fertilised ovum is thrust out of the hen's body, when the egg is laid. It is kept warm in the nest, and the whole development goes on outside the body.

The Human Child

In mammals in general, the fertilised ovum is retained within the female and developed there for a longer or shorter period. In the beasts of prey, the flesh eaters or *carnivora*, such as cats and dogs, the young are born blind, and very feeble. If they were retained longer inside the mother she would be so heavy and clumsy that she would be unable to spring, and in the natural state would get no food. The grass eaters, deer and cattle, are born far more mature, and calves can swim considerable distances the day after they are born. If this were not so, they would be completely at the mercy of all beasts of prey, and would never survive.

The human child is retained within the mother for nine months and is born in a very helpless state.

The ovaries are small glands which contain immense numbers of ova. These come gradually to maturity one at a time, about once a month during a woman's sexual life. When mature the ovum leaves an ovary and enters the uterus or womb, which is an organ situated in the pelvis between the bladder and the rectum.

The ovum becomes embedded in the mucous membrane lining the womb, and if it becomes impregnated the *fœtus*, or child, is developed inside the womb, which grows to an enormous extent to accommodate it. If there is no impregnation, the ovum and the lining of the *uterus* are expelled, together with some blood, at monthly intervals.

The womb opens into the *vagina*, or front passage, which communicates with the outside, and into the forepart of which the *urethra* from the bladder opens. When the child is born it is forced out of the womb through the *vagina* into the world.

The female sexual organs, then, are the ovaries, which produce the eggs, the womb in which the ovum develops, and the vagina through which the womb communicates with the outside world. At the opening of the vagina are various organs connected with special sensation.

The testes are a pair of glands which secrete spermatozoa and a fluid containing mucus. Each spermatozoon is a cell consisting of a head and a long tail which is movable, and by which the spermatozoon is propelled through the fluid. The duct of the testis is called the *vas deferens;* it is a long tube which opens into the urethra where it passes through the prostate. The prostate is a gland immediately outside the bladder. The remainder of the urethra passes through the penis, and leads outside at its extremity.

During the period when the ovum is developing inside the uterus, that organ becomes enormously enlarged, and reaches above the navel. Its blood-vessels communicate with those of the fœtus, and it is through the blood vessels of the mother that the child is nourished, and so gets the necessary food to allow it to develop.

The Struggle for Existence

The birth of the child at the proper time is due to the contraction of the muscles of the uterus, which force it out into the world.

The child after birth is fed on its mother's milk; this is the secretion of the mammary glands, or breasts, which are situated one on each side of the lower part of the chest. The milk contains proteid, carbohydrate and fat, and is a complete food for the child.

These lessons may finish with a summary of what we have learnt about the structure and functions of the body.

As long as we live in this world we are faced with the struggle for existence, and it is only our natural instinct to keep alive which keeps us up to this struggle. For our livelihood we are dependent on our surroundings, from which we get our food and water and air, and to which we must be able to adapt ourselves.

In order to get our food, or to carry out

any of the activities of animals, we have first to be made aware of our surroundings. For this we have the afferent or sensory fibres of the nervous system which convey impressions to the brain from things which are in contact with the body, and also from things at a distance from the body by means of the special senses of sight and hearing.

These sensory impressions are stored in the brain as memory, and upon memory depend consciousness and reason, since it is through memory that we can compare fresh experiences with previous ones.

The Human Machine

From the brain impulses are sent down motor nerves, so that appropriate movements are made by muscles. The muscles contract and move bony levers connected by joints, and the principal movements of the human body have to do either with "locomotion" or "prehension," that is walking or grasping. Whenever any muscular movement is made, work is done, and the body can be regarded as a machine.

The muscles work as a steam engine works, carbon is burnt up by them, and carbon dioxide and nitrogenous waste materials are produced.

The loss of carbon and other materials is made up by the eating of food, which is either of animal or vegetable origin, and must contain either proteid, derived from protoplasm, and containing nitrogen, or carbohydrate (starch or sugar), or fat, and a suitable diet must contain a mixture of all three. Since food can only be absorbed in a very dilute state, and since also there is a daily loss of water through skin, lungs and kidneys, water is required with the food, as also are salts.

The food is passed through the body along the alimentary or digestive tract, where the valuable parts are dissolved out and absorbed, and from which the remainder is expelled at intervals together with the secretions of various glands.

The digested food is absorbed into the blood, which is a fluid which acts as a medium of exchange for the tissues. It brings to the tissues food and oxygen, and takes from them carbon dioxide and nitrogenous waste. In order that the blood may carry out this function it has to be circulated throughout the systems, so that its loss may be replenished and its waste materials removed.

The blood travels round the body for these purposes in the circulatory system, a closed double circuit of tubes, the systemic circulation for the body generally, and the pulmonary circulation for the lungs. The motive power is supplied by the double muscular pump, the heart, which has the power of rhythmical contraction. The left heart circulates blood through the body, and returns it to the right heart, the right heart drives it through the lungs, and returns it to the left heart. The blood leaves the heart by arteries which open into capillaries in which the exchange between blood and tissues occurs: the capillaries end in veins, which lead blood back to the heart.

Oxygen is carried in the red corpuscles of the blood, which are exposed to the air in the lungs. The hæmoglobin they contain combines with oxygen to form a loose chemical compound: in the tissues where the demand for oxygen is high, the hæmoglobin is "reduced" and gives up its oxygen. The carbon dioxide is also given up in the lungs. The air in the lungs is exchanged by an arrangement like a bellows. The cavity of the chest can be increased in size, by lowering the diaphragm and raising the ribs, so that air enters the lungs. The breathing movements are regulated by the nervous system, and depend on the amount of carbon dioxide present in the blood.

Nitrogenous Waste

The nitrogenous waste is removed from the blood, together with salts and a large quantity of water, by the kidneys. This water, the urine, passes down the ureters, accumulates in the bladder, and is expelled thence at intervals.

The skin also secretes water, and the evaporation of this cools the skin. The contraction of muscles produces heat, and yet the body always remains at the same temperature. This is regulated by the varying amounts of water lost by the skin and kidneys respectively.

In order that the species may persist when the individual dies, certain cells are set apart in the male and female for the purpose of reproduction. A new individual is developed from the fusion of one of each of these cells. This new compound cell is retained and developed within the female for a period of nine months, and is then expelled into the world.

I would add one final word; the essential fact of life is the capacity of every animal to adapt itself to its surroundings. Till this fact is grasped the principles governing the structure and functions of the body cannot be understood. D. W. C.-J.

Continued from page 357.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A.[Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

GERMAN.—XXXVI

Punctuation

On the whole, the rules for punctuation in German are much the same as in English. As far as the use of semi-colons, colons, and full stops are concerned they are identical. Commas, in so far as they separate individual words, are also used in German as in English.

As regards the separation of clauses by commas, the following is the rule: All dependent clauses must be separated from main principal clauses and from other dependent clauses by commas.

This applies not only to short adjective clauses which are not separated in English from the nouns on which they qualify, but also to noun clauses which, in English, are never separated from the verbs on which they depend.

Adjective clause: Hier iſt das Buch, welches Sie geſucht haben, *here is the book which you were looking for.*

Adverb clause: Wenn ich nach Hauſe komme, werde ich Ihnen alles erzählen, *when I come home, I will tell you everything.*

Noun clause: Er ſagte mir, daß ſie geſtern krank geworden ſei, *he told me that she had fallen ill yesterday.*

Sometimes even Infinitive phrases, which take the place of noun clauses, are separated by a comma. Thus, Er kann nicht daran denken, ſie in dieſem Zuſtand zu verlaſſen, *he cannot think of leaving her in this condition.*

On the whole, however, the tendency in modern German is to curtail the use of commas, but to be pedantically correct, the above rule must be followed.

The exclamation mark is used more frequently in German than in English, and is invariably used after a Nominative of address, where we use a comma. Thus in beginning a letter, where we write "Dear Mr. So-and-So," the Germans write: „Lieber Herr So und So!"

If the student has conscientiously worked through the above course, he should now find no difficulty in pursuing his German studies with the aid of a dictionary. It may be well to add a word of advice as to the manner in which such studies should be undertaken. To obtain a complete command of the language, the best way is to converse with natives of the country; but failing that, and in addition to that, it is an excellent thing to read as much as possible. As regards the use of a dictionary, it should be referred to as little as possible, and the student should always try to make out the meaning of a passage for himself, before having recourse to the dictionary.

We append a few remarks which may prove useful, as they bear on points that are not as a rule dealt with in grammars and dictionaries.

In addressing a person it is usual to mention that person's name. Thus, Guten Tag Herr X., Frau X., Fräulein X., *good day, Mr. X., Mrs. X., Miss X.*

Fräulein may be used without a following name, but Herr and Frau are not, as a rule, used without a following name, unless preceded by some qualifying word.

Ladies with whom one has only a slight acquaintance are addressed as Gnädige (gracious) Frau and Gnädiges Fräulein. Sir may be rendered by mein Herr.

In letter-writing the following forms of address are used: Geehrter (honoured) Herr X., Sehr geehrter Herr X., Lieber Herr X., *Dear Mr. X.*

The adjective lieb is only used to persons with whom one is on a very friendly footing.

The same qualifying words may be used with Frau followed by the name, and with Fräulein without the name. Thus, Liebe Frau X., Sehr geehrtes Fräulein, but it is more

usual to address ladies as sehr geehrte gnädige Frau or geehrtes Fräulein, unless one is on very friendly terms with them.

In business letters it is customary to write the name of the person addressed first, and then to proceed with the letter without any other form of address.

In signing letters the following are used: Hochachtungsvoll (full of high respect), Yours faithfully, Ergebenst or Ihr ergebener (devoted), Yours truly, Yours sincerely, Dein dich liebender, Your affectionate.

Below, as an exercise in translation, is given a German poem with the vocabulary and notes as usual, and we append a translation; instead of the translation from English into German, we give Brutus' speech to the Romans from Shakespeare's "Julius Caesar," followed by Schlegel's translation, to which we have added a few notes.

VOCABULARY

Sonnenuntergang, s.m.2, *sunset.*
Silber, s.n.1, *silver.*
rosig, *rosy.*
wallen, w., *to move, stream.*
dämmern, w., *to grow twilight.*
traurig, *sad.*
hervo'rbrechen, s., *to break forth.*
schimmern, w., *to glisten, twinkle.*
Göttin, w.f., *goddess.*
unschuldig, *innocent.*
zischeln, w., *to hiss.*
Zwiespalt, w.f., *dissension.*
feindlich, *in enmity.*
Ehpaar, s.n.2, *married couple.*
ob, *for, on account of.*
anbeten, w., *to adore.*
stolz, *proud.*
verwaist, *orphaned.*
weihen, w., *to dedicate, devote.*
weiblich, *feminine, womanly.*
Gemahl, s.m.2, *husband.*
bleich, *pale.*
scheiden, s., *to depart.*
ängstlich, *fearful.*
Anblick, s.m.2, *sight.*
doppelt, *double.*
Zorn, s.m.2, *anger, wrath.*
eilen, w., *to hasten.*
Verderben, s.n.1, *ruin.*
trostlos, *disconsolate.*
Elend, s.n., *misery.*
pflanzen, w., *to plant.*
klagen, w., *to complain.*
aufschauern, w., *to start up shuddering.*
Gebild, s.n.2, *formation, image.*
anhauchen, w., *to tinge.*
herbstlich, *autumnal.*
Schleier, s.m.1, *veil.*
todblas, *deathly pale.*
Funken, w.m., *spark.*
ehlich vereint, *united in wedlock.*
wimmeln, w., *to swarm.*
böse, *evil.*
Zunge, w.f., *tongue.*
sich trennen, w., *to part.*
leuchten, w., *to gleam.*
sich ergehen, s., *to walk.*
Herrlichkeit, *glory.*
besingen, s., *to praise in song.*
harten, w., *to harden.*
Wehmut, s.f., *melancholy.*
weich, *soft, gentle.*
gesinnt, *minded.*
zittern, w., *to tremble.*
hervo'rlauschen, w., *to peep forth.*
schmerzlich, *dolorously.*
verlangen, w., *to ask.*
erglühen, w., *to glow.*
Purpur, s.m.1, *purple, crimson.*
unerbittlich, *inexorable.*
Witwer, s.m.1, *widower.*
qualvoll, *in agony.*
schleppen, w., *to drag.*
niedrig, *low.*
beglücken, w., *to make happy, bless.*

Exercise 79

Sonnenuntergang.

Die glühend rote Sonne steigt
Hinab ins weit[1] aufschauernde,
Silbergraue Weltmeer;[2]
Luftgebilde,[3] rosig angehaucht,
Wallen ihr nach; und gegenüber,
Aus herbstlich dämmernden Wolkenschleiern,
Ein traurig todblasses Antlitz,
Bricht hervor der Mond,
Und hinter ihm, Lichtfünkchen,
Nebelweit,[4] schimmern die Sterne.

Einst am Himmel glänzten,
Ehlich vereint,
Luna,[5] die Göttin, und Sol,[6] der Gott,
Und es wimmelten um sie her die Sterne,
Die kleinen, unschuldigen Kinder.

Doch böse Zungen zischelten Zwiespalt,
Und es trennte sich feindlich
Das hohe, leuchtende Ehpaar.

Jetzt am Tage, in einsamer Pracht,
Ergeht sich dort oben der Sonnengott,
Ob seiner Herrlichkeit
Angebetet und vielbesungen[7]
Von stolzen, glückgehärteten[8] Menschen.
Aber des Nachts[9]
Am Himmel wandelt Luna,
Die arme Mutter,
Mit ihren verwaisten Sternenkindern,
Und sie glänzt in stiller Wehmut,
Und liebende Mädchen und sanfte Dichter
Weihen ihr Tränen und Lieder.

Die weiche Luna! Weiblich gesinnt,
Liebt sie noch immer den schönen Gemahl.
Gegen Abend, zitternd und bleich,
Lauscht Sie hervor aus leichtem Gewölk,[10]
Und schaut nach dem Scheidenden, schmerzlich,
Und möchte ihm ängstlich rufen: „Komm!
Komm! die Kinder verlangen nach dir —"
Aber der trotzige Sonnengott,
Bei dem Anblick der Gattin erglüht er
In doppeltem Purpur,
Vor Zorn und Schmerz,
Und unerbittlich eilt er hinab
In sein flutenkaltes[11] Witwerbett.

* * *

Böse zischelnde Zungen
Brachten also Schmerz und Verderben
Selbst über ewige Götter.
Und die armen Götter, oben am Himmel
Wandeln sie, qualvoll,[12]
Trostlos[13] unendliche Bahnen,
Und können nicht sterben,
Und schleppen mit sich
Ihr strahlendes Elend.

Ich aber, der Mensch,
Der Niedrig-gepflanzte, der Tod-beglückte,
Ich klage nicht länger.

Heinrich Heine.

NOTES:—

(1) weit is here an adverb meaning *far.* (2) Weltmeer, the word Welt prefixed to another gives the idea of universality. (3) Luftgebilde, —formations of air, i.e. clouds. (4) nebelweit, so far away as to appear misty. (5) Luna, the Latin name for the goddess of the moon. (6) Sol, the Latin name for the god of the sun. (7) vielbesungen, much or often praised in song. (8) glückgehärtet, literally, hardened by happiness. (9) des Nachts, this adverbial genitive of a feminine noun is formed on analogy with expressions like des Morgens. (10) Gewölk,

this, like most nouns with the prefix ge, is a collective, a group of clouds. (11) flutenkalt, literally, water-cold. (12) qualvoll, refers to Götter. (13) troſtlos, is an adverb modifying unendlich.

Exercise 80

JULIUS CAESAR—Act III., Scene 2

BRUTUS' SPEECH TO THE ROMANS AFTER CAESAR'S DEATH

Brutus.—Be patient till the last.

Romans, countrymen, and lovers! hear me for my cause, and be silent, that you may hear: believe me for mine honour, and have respect to mine honour, that you may believe: censure me in your wisdom, and awake your senses, that you may the better judge. If there be any in this assembly, any dear friend of Caesar's, to him I say that Brutus' love to Caesar was no less than his. If then that friend demand why Brutus rose against Caesar, this is my answer: not that I loved Caesar less, but that I loved Rome more. Had you rather Caesar were living, and die all slaves, than that Caesar were dead, to live all free men? As Caesar loved me, I weep for him; as he was fortunate, I rejoice at it; as he was valiant, I honour him; but as he was ambitious, I slew him. There is tears for his love; joy for his fortune; honour for his valour; and death for his ambition. Who is here so base that would be a bondman? If any, speak; for him have I offended. Who is here so rude that would not be a Roman? If any, speak; for him have I offended. Who is here so vile that will not love his country? If any, speak; for him have I offended. I pause for a reply.

All.—None, Brutus, none.

Brutus.—Then none have I offended. I have done no more to Caesar than you shall do to Brutus. The question of his death is enrolled in the Capitol; his glory not extenuated, wherein he was worthy, nor his offences enforced, for which he suffered death.

Here comes his body, mourned by Mark Antony; who, though he had no hand in his death, shall receive the benefit of his dying, a place in the commonwealth; as which of you shall not? With this I depart—that, as I slew my best lover for the good of Rome, I have the same dagger for myself, when it shall please my country to need my death.

W. Shakespeare.

Key to Exercise 77

For fish and seagulls it may have been a memorable day when the depths roared and hissed (there was roaring and hissing in the depths) and the blocks of red-hot (glowing) basalt forced their way through the cracks in the earth's crust, over the surface of the waters. But that is a long time ago. Grass has grown over the sufferings of those who were pitilessly destroyed in that upheaval; only the hills still stand, unconnected with their neighbours, lonely and defiant, like all those who, animated by fiery and volcanic energy, break through the barriers of existing things, and their rocks resound as if they harboured a memory (as if a memory lodged in them) of their joyous youth, when they first greeted the splendour of creation with exultation.

At the time when our story begins, the high Twiel was already crowned (already bore) with a tower and walls, a strong citadel. There Master Burkhard had lived, the Duke of Swabia. He was a notable soldier, and had been through (made) many campaigns; the Emperor's enemies were his too, and hence there was always work: when things were (it was) quiet in Italy, the Normans up above began, and when they were overthrown, at some time or other the Hungarian would come riding along, or else some bishop was presumptuous, or some count unruly—so Master Burkhard in his lifetime had sat more in the saddle than in his armchair. Accordingly it is explicable that he had acquired no gentle reputation.

In Swabia they said he had ruled, so to speak, as a despot, and in distant Saxony the monks wrote in their chronicles that he had been an almost insupportable warrior.

Before Master Burkhard was gathered to his fathers, he took a wife. This was the young Lady Hadwig, daughter of the Duke of Bavaria. But the morning star cannot shine joyously on the (in the) evening glow of a life that is on the wane. That is due to (has) natural causes. Therefore Lady Hadwig had taken the old Duke of Swabia to please her father, had cherished and nursed him as befitted his grey hairs (head), but when the old man came to die, grief did not break her heart.

Key to Exercise 78

Das Dorf war zwar in Sicht, aber ſo viel ich wußte hätte es eine Todtenſtadt ſein können; kein Geräuſch kam dorther, kein Rauch ſtieg von den Dächern auf, weder Menſch noch Tier war ſichtbar, kein Leben, keine Bewegung — es ſah ſo verödet aus wie das Schloß ſelbſt. Dennoch war ich auf das Abenteuer erpicht, und ich ging weiter über die grüne Ebene dem Schloße zu, indem ich gelegentlich einen ängſtlichen Blick um mich warf; und nun war ich dicht dabei.

Es war von einer vierwinkligen Mauer umgeben, ungefähr zehn Fuß hoch, mit einem viereckigen Turm an jedem Winkel. Zuerſt konnte ich keinen Eingang entdecken; aber als ich nach der nördlichen Seite ging, fand ich ein breites, hohes Tor mit einem Turm darüber, ähnlich denen am Winkel der Mauer; an dieſer Seite fiel der Boden ſanft nach dem Moraſt ab, welcher hier von einem üppigen Gewächs von Unterholz und immergrünen Eichen umgeben war. Ich ging durch das Tor, und befand mich in einem viereckigen, eingehegtem Grundſtück von ungefähr zwei Morgen. An der einen Seite erhob ſich eine runde und hohe Hauptfeſte, oder ein Kerker, mit einem kegelförmigen Dach, wovon ein Teil heruntergefallen war und den Hof mit ſeinen Trümmern bedeckt hatte. Dicht neben der Hauptfeſte, an der andern Seite, ſtanden die Reſte eines länglichen Hauſes, mehr oder weniger im modernen Stil gebaut, mit verſchiedenen Fenſterhöhlen; nichts war übrig geblieben als die nackten Mauern und einige hervorſtehende Balkenreſte, die halb abgebrannt zu ſein ſchienen. Die Innenwände waren auch wie vom Feuer geſchwärzt; Feuer ſchien auch zu einer Zeit aus den Fenſterhöhlen gewütet zu haben, denn die Außenſeite um ſie herum war ſchwarz, gräslich ſchwarz. „Mich wundert was hier vorgegangen iſt?" rief ich aus.

Key to Exercise 79

The following translation, being prose, does not give any adequate idea of the beauty of the original.

SUNSET

The red glowing sun sinks down into the far shuddering, silver-grey ocean; rosy tinted, airy shapes float after him; and opposite, from beneath cloud-veils that have a dull, autumn gleam, a sad, death-pale countenance, the moon breaks forth,

and behind her, little sparks of light, mistily distant, the stars twinkle.

Once, united in wedlock, Luna, the goddess, and Sol, the god, shone in the heavens, and round about them swarmed the stars, little, innocent children.

But evil tongues hissed discord, and the exalted, radiant couple parted in enmity.

Now by day, in lonely splendour, the sungod moves up yonder, adored by men grown hard in happiness, and oft praised in song for his glory. But at night Luna wanders through the sky, poor mother with her orphan star-children, and she shines in silent melancholy, and loving maidens and gentle poets make offering to her of tears and songs.

Soft-hearted Luna, in womanly fashion she still loves her beautiful spouse. Towards evening, trembling and pale, she peeps forth from airy clouds, and gazes after her departing lord, in sorrow, and would like to call to him: "Come! Come! the children are longing for thee!" But the defiant sungod, at the sight of his wife, glows with a deeper crimson from wrath and pain, and inexorable, he hastens down into his cold and watery widower's bed.

Evil, hissing tongues thus brought sorrow and ruin even upon immortal gods. And the poor gods, up in the heavens, they pursue in agony their disconsolate unending courses, and cannot die, and must bear the burden of their glittering misery.

But I, a man, lowly placed and blessed with death, I will murmur no more.

Key to Exercise 80

Brutus.—Seid ruhig bis zum Schluß.

Römer! Mitbürger! Freunde! Hört mich meine Sache führen,[1] und ſeid ſtill, damit ihr hören möget. Glaubt mir um meiner Ehre willen, und hegt Achtung vor meiner Ehre, damit ihr glauben mögt. Richtet mich nach eurer Weisheit, und weckt eure Sinne, um deſto beſſer urtheilen zu können. Iſt jemand in dieſer Verſammlung, irgend ein herzlicher Freund Cäſars, dem ſage ich: des Brutus Liebe zum Cäſar war nicht geringer als ſeine. Wenn dieſer Freund dann fragt, warum Brutus gegen Cäſar aufſtand, iſt dies meine Antwort: nicht, weil ich Cäſarn[2] weniger liebte, ſondern weil ich Rom mehr liebte. Wolltet ihr lieber, Cäſar lebte und ihr ſtürbet alle als[3] Sklaven, als daß Cäſar todt iſt, damit ihr alle lebet wie[4] freie Männer? Weil Cäſar mich liebte, wein' ich um ihn; weil er glücklich war, freue ich mich; weil er tapfer war, ehr' ich ihn; aber weil er herrſchſüchtig[5] war, erſchlug ich ihn. Alſo[6] Thränen für ſeine Liebe, Freude für ſein Glück, Ehre für ſeine Tapferkeit, und Tod für ſeine Herrſchſucht. Wer iſt hier ſo niedrig geſinnt,[7] daß er ein Knecht ſein möchte? Iſt es jemand,[8] er rede,[9] denn ihn habe ich beleidigt. Wer iſt hier ſo roh, daß er nicht wünſchte, ein Römer zu ſein? Iſt es jemand, er rede, denn ihn habe ich beleidigt. Ich halte inne, um Antwort zu hören.

Alle.—Niemand, Brutus, niemand.

Brutus.—Dann habe ich niemand beleidigt. Ich that Cäſarn[10] nichts, als was ihr dem Brutus thun würdet. Die Unterſuchung[11] über ſeinen Tod iſt im Capitol aufgezeichnet[12]: ſein Ruhm nicht geſchmälert,[13] wo er Verdienſte[14] hatte, ſeine Vergehen nicht übertrieben,[15] für die er den Tod gelitten.[16]

Hier kommt ſeine Leiche, vom Mark Anton betrauert, der, ob[17] er ſchon keinen[18] Theil an ſeinem Tode hatte, die Wohlthat ſeines Sterbens, einen Platz im gemeinen Weſen,[19] genießen wird. Wer von euch wird es nicht? Hiermit trete ich ab: wie ich meinen beſten Freund für das Wohl Roms erſchlug, ſo habe ich denſelben Dolch für mich ſelbſt, wenn es dem Vaterlande gefällt, meinen Tod zu bedürfen. A. W. von Schlegel.

NOTES ON THE GERMAN TRANSLATION:—

(1) eine Sache führen, literally, to plead a cause. (2) Cäſarn, the accusative. (3) als Sklaven ſterben, to die as slaves; it is not possible to omit the *as* in German. (4) wie, the same meaning as als above. (5) herrſchſüchtig, literally, desirous of power. (6) alſo, like the French *voilà*. (7) niedrig geſinnt, literally, base minded. (8) iſt es jemand, *if any one is so*. (9) er rede, the conjunctive used for the third person Imperative. (10) Cäſarn, dative. (11) Unterſuchung, *inquiry, examination*. (12) aufgezeichnet, *written down*. (13) geſchmälert, *narrowed, lessened*. (14) Verdienſte, *merit*. (15) übertrieben, *exaggerated*. (16) After gelitten supply the auxiliary hat. (17) In modern German obſchon is written as one word and not divided as here. (18) keinen . . . hatte, *had no part in his death*. (19) Weſen, literally, existence, life.

M. A. L.

RUSSIAN.—XXX

10—Answer to Letter No. 9

Въ видý сúльнаго спрóса на нáши вéльветы предоставлéніе едúнственной продáжи на нихъ, по нáшему убѣждéнію, не мóжетъ соотвѣтствовать нáшимъ интерéсамъ, а потомý покóрнѣйше прóсимъ Васъ соблаговóлить великодýшно извинúть нашъ невóльный отказъ въ удовлетворéніи Вáшему желáнію.

Taking into consideration the big demand for our velvets, the granting of exclusive sales for them is, in our conviction, not likely to be compatible with our interests, and we therefore most respectfully ask you to be so generous as to excuse our involuntary refusal to comply with your wishes.

11—Another Answer to Letter No. 9

Мы охóтно готóвы предостáвить Вамъ едúнственную продáжу на нашъ нóвый вéльветъ на весь Югъ Россíи за 1921-ый годъ, éсли обя́жетесь купúть у насъ не мéнѣе . . . кускóвъ, кáждый въ . . . я́рдовъ, въ течéніе того́ гóда.

We are quite prepared to transfer to you the exclusive sale of our new velvet for the whole of the South of Russia in the year 1921, if you undertake to buy from us in that year not less than . . . pieces of . . . yards each.

12—Application for Bank Credit

Для бóлѣе успѣшнаго развúтія моúхъ торгóвыхъ операцúй мнѣ къ настоя́щему сезóну трéбуется кредúтъ отъ десятú до двадцатú ты́сячъ рублéй. А потомý честь имéю обратúться къ Вамъ съ прóсьбой объ открытіи мнѣ такóваго кредúта въ слѣдующихъ размѣрахъ:

Половúна въ вúдѣ блáнковаго кредúта.

For the purpose of developing my business transactions more successfully I am in need of some ten to twenty thousand roubles for this season, and I therefore apply to you with the request to open me such credit in the following proportions:

One half in the form of blank credit. The

Остально́е подъ обезпе-
чéніемъ покупáтельскихъ
векселéй срóками не
дáльше шести́ мѣсяцевъ.

remainder on the secur-
ity of customers' bills
at terms not exceeding
six months.

13—Answer to Letter No. 12

По дирéкторскому
совѣщáнію . . . Банкъ
рѣши́лъ предостáвить
Вамъ кредúтъ въ слѣду-
ющихъ размѣрахъ:

5,000 рублéй подъ
обезпечéніемъ блáнко-
ваго вéкселя; 10,000
рублéй подъ обезпечé-
ніемъ покупáтельскихъ
векселéй, не превышá-
ющихъ шестимѣсячнаго
срóка.

As a result of the di-
rectors' consultation the
. . . Bank has decided
to grant you credit in
the following propor-
tions:

5,000 roubles against
bill in blanco; 10,000
roubles against custo-
mers' bills at terms not
exceeding six months.

14—Application for Trade Credit

Предвúдя значúтель-
ное оживлéніе въ хóдѣ
моéй торгóвли, я симъ
позволя́ю себѣ́ обрат-
и́ться къ Вамъ съ прó-
сьбой объ увеличéніи
предост áвленной мнѣ
нóрмы кредúта.

Foreseeing a consider-
able expansion in my
business, I take the
liberty of asking you
kindly to extend the
limits of my credit.

15—Answer to Letter No. 14

Въ видý на́шего обш-
и́рнаго крýга покупáте-
лей намъ, къ сожалѣнію,
абсолю́тно невозмóжно
сосредотóчивать въ нас-
тоя́щее врéмя крýпныхъ
капитáловъ въ однúхъ
рукáхъ. Но при мал-
ѣйшей возмóжности мы
охóтно поспѣши́мъ
удовлетвори́ть Вáшему
желáнію.

The circle of our cli-
ents being so great, it is
at present, to our regret,
absolutely impossible for
us to concentrate huge
capital in single con-
cerns. But at the slight-
est possibility to do so
we shall readily be on
the alert to comply with
your wishes.

16—Another Answer to Letter No. 14

По взвѣшивании всѣхъ
обстоя́тельствъ мы рѣш-
и́ли увели́чить Вашъ кре-
ди́тъ до двухъ ты́сячъ
рублéй, каковáя нóрма,
надѣемся, дасть Вамъ
возмóжность сдѣлать съ
нáми значúтельный обо-
рóтъ.

After mature consider-
ation we have decided to
increase your credit up
to two thousand roubles,
which extent, we hope,
will enable you to do a
considerable turnover
with us.

17—Inquiry about Goods, Prices, and Terms

По получéніи сего́
благово́льте мнѣ вы́слать
Вашъ каталóгъ и образцы́
Ва́шихъ послѣднихъ
новостéй съ обозначé-
ніемъ крайнѣйшихъ
цѣнъ и услóвій продáжи.

On receipt of this
kindly send me your
catalogue with samples
of your latest novelties
along with lowest prices
and terms.

18—Answer to Letter No. 17

Благодари́мъ Васъ за
любéзный запрóсъ и
отдѣльнымъ конвéртомъ
посылáемъ Вамъ нашъ
иллюстрúрованный ката-
лóгъ вмѣстѣ съ образ-
цáми. Цѣны обознáчены
на обрáзчикахъ и разу-
мѣются нéтто за налúч-
ный разчётъ.

We thank you for the
kind inquiry and are
sending you under separ-
ate cover our illustrated
catalogue with samples.
The prices are marked
on the samples and are
net cash.

19—Inquiry about the Standing of a Firm

Въ сúлу нáшихъ
долголѣтнихъ дрýжеск-
ихъ сношéній симъ поз-
воля́ю себѣ́ обрати́ться
къ Вамъ съ покóрнѣйшей
прóсьбой объ удѣлéніи
мнѣ свѣдѣній о благона-
дёжности и кредитоспо-
сóбности фúрмы, úмя
котóрой знáчится на
отдѣльно-прилóженномъ
здѣсь клочкѣ бумáги.

Торжéственно обѣщáю
Вамъ сохрани́ть Вáши
сообщéнія въ строжáй-
шей тáйнѣ и пóльзоваться
Вáшимъ дóбрымъ совѣ́-
томъ безъ малѣйшей
отвѣтственности съ Ва́-
шей стороны́.

On the strength of our
long friendly relations I
take herewith the liberty
of applying to you kindly
to give me some in-
formation about the re-
liability and credit value
(financial standing) of
the firm whose name is
given on the enclosed
separate slip.

I solemnly promise to
keep your communica-
tions in the strictest se-
crecy and to avail my-
self of your kind advice
without the slightest re-
sponsibility on your
part.

20—Answer to Letter No. 19

Хотя́ úмя запра́шива-
емой Вáми фúрмы мнѣ
довóльно извѣстно, я всё
такúй не въ состоя́нии
дать Вамъ тóчныхъ
свѣдѣній, такъ какъ онá
всегó существýетъ какúхъ нибýдь два-три гóда.
Владѣльцы фúрмы, два
молоды́хъ человѣка,
повúдимому, óчень эне-
ргúчны, слúшкомъ бóйки
и нѣсколько тéрпки.
Они́ сúльно анонси́руютъ
въ газéтахъ и всячески
бьютъ на большóй эф-
фектъ. Послѣдствія тру́д-
но предвúдѣть. Въ
предоставлéніи кредúта
совѣтуется руковóдство-
ваться всесторóнней
осторóжностью. Безъ
моéй отвѣтственности.

Though the name of
the firm in question is
well known to me, I am
none the less unable to
give you any definite in-
formation about same,
as it has only been in
existence some two or
three years. The owners
of the firm, two young
men, are apparently very
energetic, too daring and
somewhat abrupt. They
advertise much in the
papers and try hard to
make a big show. The
consequences are hard to
estimate. In granting
credit it would be ad-
visable to be guided by
an all-round circumspec-
tion. Without my
responsibility.

21—Another Answer to Letter No. 19

Запрóшенная Вáми
фúрма существýетъ
бóлѣе полвѣка. Онá

The firm in question
has been in existence
over half a century. It

извѣстна въ Россіи, какъ одна изъ передовыхъ фирмъ, ведущихъ свой дѣла спокойно, аккуратно и основательно. Въ благонадѣжности фирмы нѣчего сомнѣваться, но размѣръ заслуживаемаго кредита не можетъ быть мною опредѣленъ.

is known in Russia as one of the leading firms which conduct their business in a quiet, accurate, and thorough manner. There is no ground for questioning the solidity (standing) of the firm, but I am unable to estimate the extent of credit it deserves.

22—Offer of Goods

Я на дняхъ получилъ большой транспортъ товаровъ, содержащихъ въ себѣ множество достопримѣчательныхъ новостей. Покорнѣйше прошу Васъ дозволить мнѣ выслать Вамъ ассортиментъ въ размѣрѣ пятисотъ—шестисотъ рублей для открытія сезона. Я увѣренъ, что мой товаръ, какъ по качеству, такъ и цѣнамъ, вполнѣ заслужитъ Вашего уважаемаго одобренія.

I have received these days a large parcel of goods comprising many noteworthy novelties. Kindly allow me to send you an assortment up to five or six hundred roubles with a view of opening the season. I am sure of my goods fully meeting with your esteemed approval, both in respect of quality and price.

23—Answer to Letter No. 22

Я намѣреваюсь вскорѣ быть въ Вашемъ городѣ и посѣщу Вашъ складъ.

I intend visiting your town soon and shall then pay a call at your warehouse.

24—Sending an Order

При семъ прилагаю заказъ, полученіе коего благоволите подтвердить телеграммой.

Enclosed please find an order, the acceptance of which kindly acknowledge by wire.

25—Answer to Letter No. 24

Подтверждая мою телеграмму, гласящую: "Высылаю," симъ благодарю Васъ за любезный заказъ, который я съ удовольствіемъ принялъ къ скорому, точному и аккуратному исполненію.

Confirming my telegram: "Sending," I beg to thank you for the kind order, which I have accepted with pleasure for prompt, strict, and accurate execution.

26—Another Answer to Letter No. 24

Я телеграфировалъ Вамъ сегодня: "Высылка невозможна, письмомъ подробно," и настоящимъ спѣшу извѣстить Васъ, что при скромности моего заработка мнѣ рѣшительно невозможно измѣнить моихъ цѣнъ и условій, изложенныхъ въ моемъ письмѣ отъ . . .

I have telegraphed to you to-day: "Dispatch impossible; letter follows," and with the present I beg to inform you that on account of my small profit I am unable to recede from my prices and terms given in my letter of . . .

27—Cancellation of Order

Въ виду Вашего несогласія на мои цѣны и условія симъ прошу Васъ считать мой заказъ отъ . . . уничтоженнымъ.

Owing to your non-acceptance of my prices and terms I beg you to consider my order of . . . as cancelled.

28—Remittance

Въ уравненіе Вашего счета отъ . . . при семъ прилагаю вексель на сумму . . руб . . . . коп . . . . срокомъ . . . . полученіе коего благоволите подтвердить обратной почтой.

In settlement of your invoice of . . . I beg to enclose bill of exchange for . . . roubles, . . . copecks, due on . . . the receipt of which kindly acknowledge by return of post.

29—Acknowledgment of Receipt

Симъ подтверждаю полученіе Вашего векселя на сумму . . . руб . . . . коп . . . . срочный . . . , который съ благодарностью записалъ на кредитъ Вашего счета.

I beg to acknowledge the receipt of your bill of exchange for the sum of . . . roubles, . . . copecks due on . . . with which I have credited your account with thanks.

30—Claim

Просматривая Вашъ счетъ отъ . . . , я открылъ въ немъ ошибку на четвертой линіи. Благоволите провѣрить Вашу фактуру отъ сказаннаго числа и кредитовать мой счетъ разницей.

On checking your invoice of the . . . I have discovered a mistake in same on the fourth line. Kindly verify your invoice of the said date and credit my account with the difference.

31—Answer to Letter No. 30

Спѣшимъ извиниться за невольную ошибку и настоящимъ препровождаемъ Вамъ кредитную записку на сумму . . . , составляющая разницу по нашему счету отъ . . .

We hasten to apologise for the inadvertent mistake, and enclosed please find Credit Note for the sum of . . ., which constitutes the difference in our invoice of . . .

32—Complaint

Вашъ товаръ прибылъ съ большими поврежденіями. По причинѣ дурной упаковки гвозди прорѣзали нѣкоторыя мѣста, образовавъ большія дыри въ сукнѣ. Цвѣта нѣкоторыхъ матерій оказались совершенно полиняными. Я крайне недоволенъ Вашимъ образомъ дѣйствій и, такъ какъ товаръ въ подобномъ состояніи для меня рѣшительно безполезенъ, я отказываюсь отъ принятія такового, оставляя его на Ваше распоряженіе.

Your goods have landed heavily damaged. Owing to bad packing, nails have penetrated in several places, forming big holes in the cloth. The colours of some stuffs have turned out absolutely faded. I am greatly dissatisfied with your behaviour, and, as the goods in such a state are quite useless to me, I refuse to accept them, leaving same at your disposal.

A. C.

GREEK.—XVII

Invariable Words

We now have to deal with words that either undergo no change or change to a very slight extent. These comprise prepositions, adverbs, conjunctions, and interjections.

Prepositions

The original meaning of the prepositions was certain relations in regard to place. The eighteen prepositions proper are classified on this basis in the following table:—

Place Relation.	*Preposition.*	*Case Governed.*
where, position	ἐν, *in.*	dat.
whither, destination	εἰς or ἐς, *into, to*	acc.
	πρός, *to, towards*	acc., *to*, etc.; dat., *in addition to, at*; gen., *in front of, from*
whence, origin	ἐκ or ἐξ, *from, out of*	gen.
	ἀπό, *from, out of*	gen.
through, by	διά, *through, by means of*	gen., *through*, etc., acc., *on account of*
	ἀνά, *up along*	acc.
down along	κατά, *down from, down upon*	gen., *down from*, etc.; acc., *down along, during*
beside	παρά, *by, near, beside, beyond*	acc., *by*, etc.; gen., *from*; dat., *near*
amidst, with	μετά, *amidst, into*	acc., *amid*, etc.; dat., *among*; gen., *with*
with	σύν or ξύν, *with*	dat.
over	ὑπέρ, *over, beyond*	acc., *over*, etc.; gen., *over, for*
under	ὑπό, *under*	acc. and dat., *under*; gen., *under, by*
before	πρό, *before*	gen.
on both sides of	ἀμφί, *about*	acc., dat., (rarely in prose) gen.
on all sides of	περί, *around, about*	acc., gen., (rarely in prose) dat.
on	ἐπί, *on, upon*	gen and dat., *on*, etc.; acc., *towards, against*
against	ἀντί, *against, instead of*	gen.

The prepositions given above are compounded with various verbs. There are others, called improper prepositions, which may not be so compounded, viz.:—ἄνευ, ἄτερ, *without*; ἕνεκα, *on account of*; ἄχρι, μέχρι, *until*; μεταξύ, *between*; πλήν, *except*; ὡς, *to*. All except ὡς, which is used only with persons and governs the accusative, take the genitive case.

Adverbs

Some adverbs of place are derived from prepositions, such as the following:—

ἔνδον, ἔντος, *within*	from the preposition	ἐν, *in*
εἴσω, *within* (of motion)	,,	,,	,,	εἰς, *into*
πρόσω, *forward*	,,	,,	,,	πρός, *to, towards*
ἐκτός, ἔξω, *outwards, outside*	,,	,,	,,	ἐκ, ἐξ, *out of*

Adverbs of place:—

Place Where.	*Place Whither.*
ποῦ, πόθι, *where?*	ποῖ, πόσε, *whither?*
ἐκεῖ, ἐκεῖθι, *there*	ἐκεῖσε, *thither*
οἴκοι, οἴκοθι, *at home*	οἰκόνδε, *home*
Ἀθήνησι, *at Athens*	ἀλλόσε, *somewhere else*
	Ἀθήναζε, *to Athens*

Place Whence.	*Place through which.*
πόθεν, *whence*	
ἐκεῖθεν, *thence*	πῆ, *by what way*
οἴκοθεν, *from home*	ἐκείνῃ, *by that way*
ἄλλοθεν, *from some other place*	ἄλλῃ, *by some other way*
Ἀθήνηθεν, *from Athens*	

Principal adverbs of time:—

σήμερον, *to-day* (from ἡμέρα, *a day*)	ἤδη, *by this time*
	ἔτι, *yet, still*
αὔριον, *to-morrow*	ἄρτι, *lately, but now*
χθές, *yesterday*	αὐτίκα, *immediately*
προχθές, *the day before yesterday.*	τότε, *then*
πρωί, *in the morning*	ποτέ, *some time*
ὀψέ, *in the evening*	θαμά, *often*
νῦν, νυνί, *now*	ἀεί, *always, successively*
πάλαι, *of old, formerly*	οὔποτε, *never*
οὔπω, *not yet*	πρίν, *previously, before*
	εἶτα, *next, then*

Most of the adverbs of manner are derived from adjectives, as σοφῶς, *wisely*, from σοφός, *wise*, εὐδαιμόνως, *fortunately*, from εὐδαίμων, *happy*. Others have the form of the genitive, as ἑξῆς, *forthwith*; the dative, ἡσυχῇ, *peacefully*; or the accusative, μάτην, *in vain*.

Adverbs of quantity:—

ἄγαν, *too much*; λίαν, *extremely*; ἄδην, *abundantly*; ἄλις, *sufficiently*. This group includes the numeral adverbs, ἅπαξ, *once*; δίς, *twice*; τρίς, *thrice*; πολλάκις, *many times*.

Adverbs of interrogation:—

ἦ simply asks a question—

ἦ λέγεις τοῦτο; *do you say this?*

ἆρα has the sense of then? really?

ἆρα λέγεις τοῦτο; *do you, then, say this?*

μῶν (μὴ οὖν) anticipates a negative, like the Latin *num*—

μῶν λέγεις τοῦτο; *you do not say this, do you?*

The adverbs of affirmation or asseveration are ἦ, ἦ μήν, *certainly, in truth*; ἄρα, τοί, δή, *then, certainly, assuredly*; μέν, *indeed*; γε, *at least*; ναί, *yes, truly*.

The adverbs of negation are οὐ (οὐκ, οὐχ) and μή, the correct use of which requires careful observation. The general distinction between the two is that οὐ is used with matters of fact, and μή with matters of desire, thought, purpose, etc. The same distinction applies to their derivatives, οὐδείς, οὐδέ, οὔτε, μηδείς, μηδέ, μήτε, etc.

Οὐ is regularly used with the indicative in independent sentences, and also with the optative except when this expresses a wish.

Μή is regularly used with the subjunctive and imperative, and with the other moods in final and

objective clauses, in conditional sentences, and in the expression of a wish.

Μή is also used with the infinitive, except in oratio obliqua, when οὐ is used.

The adverbs of doubt are ἴσως, τάχα, που, *perhaps, probably*; δήπου, δῆθεν, *apparently.*

Conjunctions

The following is a list of the chief conjunctions:—

καί, τε, *and*	ὅτι, *that*
ἤ, *or*	ὡς, ὥστε, *so as, so that*
οὔτε, μήτε, οὐδέ, μηδέ, *nor*	ἵνα, *in order that*
ἀλλά, δέ, *but*	ἵνα μή, *in order that not, lest*
μέντοι, *however*	
καίτοι, *yet*	ἐπεί, *because, since*
ἄρα, *then*	διότι, *because, that*
οὖν, τοίνυν, *therefore*	γοῦν, *therefore*
γάρ, *for*	ἐπειδή, *since*
εἰ, ἄν, ἐάν, *if*	ἐπειδάν, *after that*
εἴτε, *or, whether*	ὅτε, ὅταν, *when*
εἰ μή, *unless, if not*	ἕως, *until*
εἰ καί, *and if*	ὅπως, *how?*
κἄν, *and if*	ὡς, ὥσπερ, *as, as if*

Miscellaneous Constructions

The particles μέν and δέ are used to mark antitheses, thus:—

σὺ πρὸς χάριν μὲν οὐκ ἐρεῖς, κλαίων δ' ἐρεῖς,
Thou wilt not say this to oblige me, but thou shalt say it to thy cost.

The article, which was originally a demonstrative pronoun, is regularly used in this way to mark opposition, as in:—

ὁ μὲν σωφρονέστατός ἐστιν, ὁ δὲ ἀκρατέστατος,
This one is the most temperate, that one the most intemperate.

The accusative is the case of the direct object, but some verbs take an accusative of kindred meaning, called the cognate accusative, as τρέχει μακρὸν δρόμον, *he runs a long course.*

The substantive may be omitted, as in μεγάλα ἥμαρτεν, *he committed great faults.*

The accusative of respect indicates the part or thing affected, as in ἀλγῶ τὴν κεφαλήν, *I have a pain in the head*; καλὸς τὸ εἶδος, *beautiful in form.*

From the use of the accusative are derived many adverbs, as ἀρχήν, *in the beginning*; δίκην, *after the manner of*; τὸ πρῶτον, *at first*; τὸ λοιπόν, *for the rest*; τὸ ἐναντίον, *contrariwise*; χάριν, *for the sake of*; ταῦτα, in respect of this.

The accusative is used to denote extent of time or space, as in τρεῖς ἡμέρας ἐνόσουν, *I was ill three days*; Μέγαρα ἀπέχει Συρακουσῶν πλοῦν οὐ πολύν, *Megara is no long voyage distant from Syracuse.*

Two accusatives, of the person and the thing, are taken after verbs of asking, depriving, teaching, making, etc.; example:—

Οἱ Ἀθηναῖοι τοὺς Θηβαίους χρήματα ᾔτησαν,
The Athenians asked the Thebans for money.

The accusative of the secondary object is usually retained when the construction is turned into the passive, thus:—

οἱ πολέμιοι τὰς ναῦς ἀφῃρέθησαν,
The enemy were deprived of their ships.

The dative is used to denote the indirect object, or that to or for which the action of the verb is performed, or to denote the cause, instrument, manner, or attendant circumstances.

Dative of Indirect Object

οἱ Ἀθηναῖοι ἐπολέμουν τοῖς Κορινθίοις,
The Athenians were at war with the Corinthians.

ἔδωκεν ἡμῖν πολλὰ τὰ ἀγαθά,
Many were the good things he gave us.

The dative of attendant circumstances is exemplified in the following:—

πολλοῖς στρατιώταις πορεύεται,
He proceeds with a large number of troops.

λιμῷ ἀπώλετο,
He died of famine.

The genitive expresses various relations which in English are expressed by the preposition *of* or the possessive case. These relations, as in Latin, comprise possession or origin, partition, separa definition, respect or reference, etc.

τὰ ἔργα τοῦ Πραξιτέλους κάλλιστα ἦν,
The works of Praxiteles were very beautiful.

The following are examples of the genitive of material, definition, measure, and other relations:—

Πάσσε δ' ἁλὸς θείοιο,
He sprinkled it with sacred salt.

Παρίου λίθου τὸν νεὼν ἐποίησαν,
They built the temple of Parian marble.

The genitive follows verbs expressing similar relations, and also verbs of aiming, hitting, touching, taking hold of, perceiving, forgetting, etc., as in:—

υἱὸς λέγεται ὁ Κῦρος γενέσθαι Καμβύσου,
Cyrus is said to have been son of Cambyses.

ὅτ' ἤσθετ' ὀρθίων κηρυγμάτων,
When he heard the loud proclamation.

τοξεύειν σκοποῦ,
To shoot at a mark.

The genitive absolute, like the ablative absolute in Latin, is a variety of the genitive of attendant circumstances; examples:—

ταῦτα ἐγένετο Κύρου βασιλεύοντος,
This happened when Cyrus was reigning.

Οὔτις ἐμοῦ ζῶντός σοι βαρείας χεῖρας ἐποίσει,
While I live, no man shall lay heavy hands on thee.

Key to Exercise 16

(*a*) 1. But let them well understand this at any rate that they have not run away: for I know where they have gone; nor have they taken flight. 2. And this word in truth did not seem to have been spoken wide of the mark. 3. For they gave to each one of them a half-pint of water and two half-pints of corn daily for eight months. 4. The general got into the city before the enemy. 5. Many misfortunes befell my children coming hither. 6. May Apollo punish that evildoer.

(*b*) 1. Σοφοῖς, ὁμιλῶν καὶ αὐτὸς ἐκβήσῃ σοφός. 2. Τοὺς κακούργους οἱ θεοὶ ἀποτίσαιντο. 3. Οἱ πολῖται τοὺς πολεμίους ἔφθασαν εἰς τὴν πόλιν φυγόντες. 4. Σοφίας ὁ καρπὸς οὔποτε φθαρήσεται. 5. Πλούσιός ἐστιν οὐχ ὁ πολλὰ κεκτημένος ἀλλ' ὁ μικρῶν δεησόμενος.

Key to Exercise 17

(*a*) 1. Do you know anything practised by mankind in which the male sex is not enormously superior in all these things to the female? 2. You, then, it appears, consider those things commodities that are useful, and those that are hurtful not commodities. 3. And in truth, said the woman, will it be necessary also for me to do this? 4. You appear to call those things that are useful to each his property. 5. Even a slow man who is sound-witted can pursue and catch a swift man. 6. Odysseus came to the great hall of Hades.

(*b*) 1. Λέγειν ἔοικας, ὦ Σώκρατες, ὅτι οὐδὲ τὸ ἀργύριόν ἐστι χρήματα εἰ μή τις ἐπίσταιτο χρῆσθαι αὐτῷ. 2. Καὶ τούτου πότερα χρὴ τὸν ἄνδρα αἰτιᾶσθαι ἢ τὴν γυναῖκα; 3. Καὶ τί δέ ὀρᾷς, ἔφη ἡ γυνή, ὅ τι ἂν ἐγὼ ποιοῦσα συναύξοιμι τὸ ἄκος; 4. Θεμιστοκλῆς ὑπὸ τῶν Ἀθηναίων στρατηγὸς ᾑρέθη. 5. Ἔλθε, ὦ φίλε. 6. Ὦ ἀγαθοὶ φίλοι ἔλθετε δεῦρο. E. A. B.

ITALIAN.—XVIII

Irregular Verbs (*cont.*)—To the verbs of the Second Conjugation given in the last lesson (pp. 354, 355) must be added:—

Vedere, *to see. Past Part.*, **veduto** or **visto.**

Past Def.: vidi, vedesti, vide, vedemmo, vedeste, vídero.
Future: vedrò, etc.

Conjugate similarly **prevedere,** *to foresee*, and other derivatives.

Volere, *to wish, to will.*

Pres. Indic.: voglio, vuoi, vuole, vogliamo, volete, vógliono.
Past Def.: volli, volesti, volle, volemmo, voleste, vóllero.
Future: vorrò, etc.
Imperative: vogli, voglia, vogliamo, vogliate, vógliano.
Pres. Subj.: voglia, voglia, voglia, vogliamo, vogliate, vógliano.

Conjugate similarly the derivatives of **volere.**

Bévere or **bere,** *to drink.*

Past Def.: bevvi, bevesti, bevve, bevemmo, beveste, bévvero.
Future: berrò, etc.

Cógliere or **corre,** *to gather. Past Part.*, **colto.**

Pres. Indic.: colgo, cogli, coglie, cogliamo, cogliete, cólgono.
Past Def.: colsi, cogliesti, colse, cogliemmo, coglieste, cólsero.
Pres. Subj.: colga, colga, colga, cogliamo, cogliate, cólgano.

Conjugate similarly all verbs ending in **gliere.**

Condurre (from **condúcere**), *to conduct. Past Part.*, **condotto.**

Past Def.: condussi, conducesti, condusse, conducemmo, conduceste, condússero.
Future: condurrò, etc.

The regular tenses of this verb are formed on the stem of **condúcere.** Conjugate similarly all verbs ending in **úrre.**

Nuócere, *to hurt.* **Nocendo, nociuto.**

Pres. Indic.: nuoco (noccio), nuoci, nuoce, nociamo, nocete, nuócono (nuócciono).
Past Def.: nocqui, nocesti, nocque, nocemmo, noceste, nócquero.
Future: nocerò, etc.
Pres. Subj.: nuoca (noccia), nuoca (noccia), nuoca (noccia), nociamo, nociate, nuócano (nócciano).

Porre (from **pónere**), *to put.* **Ponendo, posto.**

Pres. Indic.: pongo, poni, pone, poniamo, ponete, póngono.
Past Def.: posi, ponesti, pose, ponemmo, poneste, pósero.
Future: porrò, etc.
Pres. Subj.: ponga, ponga, ponga, poniamo, poniate, póngano.

Conjugate similarly derivatives of **porre.**

Trarre (from **tráere** or **trággere**), *to draw.* **Traendo, tratto.**

Pres. Indic.: traggo, trái, tráe, traiámo, traéte, trággono.
Imperfect: traéva, etc.
Past Def.: trassi, traesti, trasse, traemmo, traeste, trássero.
Future: trarrò, etc.
Pres. Subj.: tragga, tragga, tragga, traiamo, traiate, trággano.

Conjugate similarly the derivatives of **trarre.**

THIRD CONJUGATION

Apparire, *to appear. Past Part,* **apparito** or **apparso**
(Like **finire.**)

Conjugate similarly **riapparire,** *to reappear.* **Scomparire, sparire,** *to disappear.*

Aprire, *to open. Past Part.*, **aperto.**
(Like **partire.**)

Conjugate similarly the derivatives of **aprire; coprire,** *to cover*, etc.

Dire (from **dícere**), *to say.* **Dicendo, detto.**

Pres. Indic.: dico, dici, dice, diciamo, dite, dícono.
Past Def.: dissi, dicesti, disse, dicemmo, diceste, díssero.
Future: dirò, etc.
Imperative: di', dica, diciamo, dite, dícano.
Pres. Subj.: dica, dica, dica, diciamo, diciate, dícano.

Conjugate similarly derivatives of **dire.**

Morire, *to die. Past Part.*, **morto.**

Pres. Indic.: muoio, muori, muore, moriamo, morite, muòiono.
Future: morrò, etc. [ate, muóiano.
Pres. Subj.: muoia, muoia, muoia, moriamo, mori-

Offrire or **offerire**, *to offer*. *Past Part.*, **offerto.**

Offrire is conjugated like **partire.**

Conjugate similarly **soffrire,** *to suffer.*

Salire, *to ascend, go up.*

Pres. Indic. : salgo, sali, sale, salghiamo, salite, sálgono.
Pres. Subj. : salga, salga, salga, salghiamo, salghiate, sálgano.

Conjugate similarly derivatives of **salire.**

Udire, *to hear.*

Pres. Indic. : odo, odi, ode, udiamo, udite, ódono.
Pres. Subj. : oda, oda, oda, udiamo, udiate, ódano.

Conjugate similarly derivatives of **udire.**

Uscire, *to go out.*

Pres. Indic. : esco, esci, esce, usciamo, uscite, éscono.
Pres Subj. : esca, esca, esca, usciamo, usciate, éscano.

Venire, *to come.* **Venendo, venuto.**

Pres. Indic. : vengo, vieni, viene, veniamo, venite, véngono.
Past Def. : venni, venisti, venne, venimmo, veniste, vénnero.
Future : verrò, etc.
Pres. Subj. : venga, venga, venga, veniamo, veniate, véngano.

Conjugate similarly derivatives of **venire.**

The following verbs ending in **-ere,** not bearing the stress, are irregular in the 1st person singular and 3rd person singular and plural of the Past Definite, and also in the Past Participle.

1. Those in **-cere** change this ending into **si** in the Past Definite and **to** in the Past Participle, as :

víncere, *to conquer ; Past Def.*, vinsi, vinse, vínsero ; *Past Part.*, vinto.
tórcere, *to twist ;* torsi, torse, tórsero ; torto.

Except :—

conóscere, *to know ; Past Def.*, conobbi, etc. ; *Past Part.*, conosciuto.
créscere, *to grow ;* crebbi, etc. ; cresciuto,
náscere, *to be born ;* nacqui, etc. ; nato.

2. Those in **-dere** change into **si** and **so,** whilst those in **-ndere** omit the **n**, as :—

evádere, *to evade ; Past Def.*, evasi, etc. ; *Past Part.*, evaso.
chiúdere, *to shut ;* chiusi, etc. ; chiuso.
préndere, *to take ;* presi, etc. ; preso.

Except :—

chiédere, *to ask ; Past Def.*, chiesi, etc. ; *Past Part.*, chiesto.
rispóndere, *to answer ;* risposi, etc. ; risposto.
scíndere, *to sever ;* scissi, etc. ; scisso.
spándere, *to spill ;* spansi, etc. ; spanto.

3. Those in **-gere** change into **si** and **to,** as :—

tíngere, *to dye ; Past Def.*, tinsi, etc. ; *Past Part.*, tinto.
vólgere, *to turn ;* volsi, etc. ; volto.

Except :—

dirígere, *to direct ; Past Def.*, diressi, etc. ; *Past Part.*, diretto.
emérgere, *to emerge ;* emersi, etc. ; emerso.
esigere, *to exact ;* esigéi, etc. ; esatto.
neglígere, *to neglect ;* neglessi, etc. ; negletto.
rifúlgere, *to shine ;* rifulsi, etc.
spárgere, *to scatter ;* sparsi, etc. ; sparso.
stríngere, *to press ;* strinsi, etc. ; stretto.
térgere, *to wipe ;* tersi, etc. ; terso.

Those ending in **-ggere** change into **ssi** and **tto,** those in **-guere** into **si** and **to,** as :—

fríggere, *to fry ; Past Def.*, frissi, etc. ; *Past Part.*, fritto.
léggere, *to read ;* lessi, etc. ; letto.
distínguere, *to distinguish ;* distinsi, etc. ; distinto.

Fíggere, *to fix*, makes Past Participle **fisso** or **fitto.**

4. Those in **-lere** change into **si** and **so,** besides altering the root vowel, as :—

espéllere, *to expel ; Past Def.*, espulsi, etc. ; *Past Part.*, espulso.

5. Those in **-ímere** change into **essi** and **esso ;** those in **úmere** into **unsi** and **unto,** as :—

sopprímere, *to suppress ; Past Def.*, soppressi, etc.; *Past Part.*, soppresso.
presúmere, *to presume ;* presunsi, etc. ; presunto.

Except :—

redímere, *to redeem ; Past Def.*, redensi, etc. ; *Past Part.*, redento.

6. Those in **-pere** change into **uppi** and **otto,** the preceding **om** becoming **u** and **o** respectively, as :—

rómpere, *to break ; Past Def.*, ruppi, etc. ; *Past Part.*, rotto.

7. Those in **-rere** change into **si** and **so,** as :—

occórrere, *to occur, to need ; Past Def.*, occorsi, etc.; *Past Part.*, occorso.

8. Those in **-tere** change into **ssi** and **sso,** as :—

incútere, *to instil ; Past. Def.*, incussi, etc. ; *Past Part.*, incusso.

Except :—

assístere, *to assist ; Past Def.*, assistéi, etc. ; *Past Part.*, assistito.
méttere, *to put ;* misi, etc. ; messo.

9. Those in **-vere** change into **ssi** and **tto,** as :—

prescrívere, *to prescribe ; Past Def.*, prescrissi, etc. ; *Past Part.*, prescritto.

Except :—

m(u)óvere, *to move ; Past Def.*, mossi, etc. ; *Past Part.*, mosso.
pióvere, *to rain ;* pióvve ; piovuto.
sólvere, *to solve ;* solvéi, etc. ; soluto.

The derivatives of these verbs are conjugated similarly.

The verbs given below also have the regular form, but the irregular one shown is more common.

Infinitive	*Past Definite*	*Past Participle*
succédere, *to succeed*	successi	successo
diféndere, *to defend*	difesi	difeso
féndere, *to split*	fessi	fesso
réndere, *to give back*	resi	reso
vívere, *to live*	vissi	vissuto
concédere, *to grant*	concessi	concesso
intercédere, *to intercede*	intercessi	intercesso
fóndere, *to melt*	fusi	fuso
connéttere, *to connect*	connessi	connesso

VOCABULARY

rinnovare, *to renew.*
però, *but.*
imparare, *to learn.*
il bicchiere, *tumbler, glass.*
la spalla, *shoulder.*
la birra, *beer.*
síngolo, *single.*
talvolta, *sometimes.*
la maestà, *majesty.*
cógliere, *to gather, seize.*
trarre, *to draw, derive.*
la congiuntura, *circumstance, opportunity.*
la circostanza, *circumstance.*
l'útile (m.), *use, advantage, profit.*
eguale, *equal, like.*
la salute, *health.*
la succursale, *branch house.*

Exercise 35

Translate into English :—

1. Cólsero quell'occasione per rinnovare la tratta. 2. Vidi l'uomo, però non gli diedi nulla. 3. Volle imparare l'italiano, prima di partire da Firenza. 4. Bevve un bicchiere di birra e se ne andò. 5. Lo díssero con cattiva intenzione, ma non mi nócquero. 6. Gli posi la mano sulla spalla e gli spiegái la situazione.

Exercise 36

Translate into Italian :—

1. I wished to learn Italian before leaving Italy. 2. They drank to the health of His Majesty and then said good-bye to each other. 3. You will see the customers next Thursday and will then know what to do. 4. He seized the opportunity to explain the situation to them. 5. It is true that I said all that, but I did not harm you in any way. 6. We shall remain in the warehouse until six o'clock.

Key to Exercise 32

1. Come vedete, diversamente da quanto avete promesso, avete ingarbugliato e reso ancor più penoso per me l'affare. 2. Saranno presto le quattro e cinque (minuti). 3. Basándomi sulla v/. promessa, avréi dovuto chiédere che la tratta fosse al mío nome. 4. Erano le dieci e mezzo o le úndici meno un quarto. 5. Quantunque sía così, ho accettato la tratta per non provocare ritardi. 6. Avete tanti libri quanti noi. 7. Dato che la merce è giunta in questi giorni a Venezia, ho aderito senz'altro alla richiesta del Crédito Italiano, per finirla con questo affare. 8. Non è così buono come súo fratello. 9. Questo affare è diventato davvero per me una nóia. 10. Il parlare una lingua straniera è più difficile che io non (*or* : più difficile di quello che) lo credevo.

Key to Exercise 33

1. The rise in the exchange gave me an opportunity of doing first-class business with abroad. 2. The exports stood yesterday at the same level. 3. I am going to-morrow to Paris and Rome. 4. When shall you go to Turin ? 5. He got them to give him some gold coins. 6. The customers gave a glance at the ribbons. 7. The price will certainly fall soon. 8. They fell on the stairs and hurt themselves. 9. The prices of all goods have fallen. 10. We shall ship the packages on the next steamer. A. C.

SPANISH.—XIX

Irregular Verbs (*continued*) :—

Decir, *to say, tell ;* **diciendo, dicho.**

Pres. Ind. : digo, dices, dice, decimos, decís, dicen.
Pres. Subj. : diga, digas, etc.
Past Def. : dije, dijiste, dijo, dijimos, dijisteis, dijeron.
Future : diré, etc.
Imperative : di (tú) !

(Conjugate similarly all compounds of **decir,** as **contradecir,** *to contradict ;* **predecir,** *to foretell,* etc.)

Dormir, *to sleep ;* **durmiendo, dormido.**

Pres. Ind. : duermo, duermes, duerme, dormimos, dormís, duermen.
Pres. Subj. : duerma, duermas, duerma, durmamos, durmáis, duerman.
Past Def. : dormí, dormiste, durmió, dormímos, dormisteis, durmieron.

Erguir, *to erect ;* **irguiendo, erguido.**

Pres. Ind. : irgo, irgues, irgue, erguimos, erguis, irguen.
(*or*) yergo, yergues, yergue, erguimos, erguís, yerguen.
Pres. Subj. : irga, irgas, irga, irgamos, irgais, irgan.
(*or*) yerga, yergas, yerga, yergamos, yergais, yergan.

Huir, *to flee.*

Pres. Ind. : huyo, huyes, huye, huimos, huis, huyen.
Pres. Subj. : huya, huyas, huya, huyamos, huyáis, huyan.

Ir, *to go ;* **yendo, ido.**

Pres. Ind. : voy, vas, va, vamos, vais, van.
Pres. Subj. : vaya, vayas, etc.
Impf. Ind. : iba, ibas, iba, íbamos, ibais, iban.
Past Def. : fuí, fuiste, fué, fuimos, fuisteis, fueron.
Imperative : ¡vé (tú) ! ; ¡vamos (nosotros) !

Morir, *to die ;* **muriendo, muerto.**

Pres. Ind. : muero, mueres, muere, morimos, morís, mueren.
Pres. Subj. : muera, mueras, muera, muramos, muráis, mueran.

Past Def.: morí, moriste, murió, morímos, moristeis, murieron.

Conjugate compounds in **-morir** similarly.

Oír, *to hear.*

Pres. Ind.: oigo, oyes, oye, oímos, oís, oyen.

Producir, *to produce.*

Pres. Ind.: produzco, produces, etc.
Past Def.: produje, produjiste, produjo, produjimos, produjisteis, produjeron.

Conjugate compounds in **-ducir** similarly.

Referir, *to refer;* **refiriendo, referido.**

Pres. Ind.: refiero, refieres, refiere, referimos, referís, refieren.
Pres. Subj.: refiera, refieras, refiera, refiramos, refiráis, refieran.
Past Def.: referí, referiste, refirió, referímos, referisteis, refirieron.

Conjugate similarly all verbs ending in **-erir** and **-vertir;** also **adquirir,** *to acquire;* **arrepentirse,** *to repent;* **concernir,** *to concern;* **discernir,** *to discern;* **hervir,** *to boil;* **inquirir,** *to enquire;* **mentir,** *to lie, to tell lies.*

Salir, *to go out, set out* (for **-para**).

Pres. Ind.: Salgo, sales, etc.
Future: Saldré, etc.
Imperative: ¡sal (tú)!

Conjugate similarly compounds in **-salir.**

Servir, *to serve;* **sirviendo, servido.**

Pres. Ind.: sirvo, sirves, sirve, servimos, servís, sirven.
Past Def.: serví, serviste, sirvió, servímos, servisteis, sirvieron.

Conjugate similarly **competir,** *to compete;* **concebir,** *to conceive;* **derretir,** *to melt;* **elegir,** *to elect;* **freir,** *to fry;* **medir,** *to measure;* **pedir,** *to order, ask, request;* **regir,** *to rule;* **reír,** *to laugh;* **reñir,** *to dispute;* **repetir,** *to repeat;* **seguir,** *to follow;* **teñir,** *to dye;* **vestir,** *to clothe.*

Venir, *to come;* **viniendo, venido.**

Pres. Ind.: vengo, vienes, viene, venimos, venís, vienen.
Past Def.: vine, viniste, vino, vinimos, vinisteis, vinieron.
Future: vendré, etc.
Imperative: ¡ven (tú)!

Conjugate similarly the compounds of **venir** as: **convenir,** *to agree, to suit, etc.*

The student is recommended to follow up this short Commercial Course with a Work in Spanish on Business Correspondence.

VOCABULARY

arriesgado, *risky, hazardous*
asargado, *twilled*
lo disponible, *spot goods, stock*
el siniestro, *accident*
examinar, *to examine, audit*
el déficit, *deficit*
apetecible, *enticing*
el prospecto, *prospectus*
la propina, *tip*
el testigo, *witness*
el abastecedora, *the supplier*
no poder menos, *not to help*
el mozo de cordel, *railway porter*
callar, *to be silent* (about)
la viuda, *widow*
el Tesoro Nacional, *National Treasury*
un poquito diferente de color, *a trifle off-shade*

Exercise 35

Translate into English:—

1. Muy Sres. ntros. (Señores nuestros): Sirve la presente para accompañarles un pedido de varios artículos. 2. Si mi socio muere antes que yo, dice el contrato que su parte de los capitales deberá quedar en la sociedad. 3. Huyo siempre de especulaciones de esa naturaleza tan arriesgada. 4. Es menester que oigamos todo lo que haya que decir sobre este asunto de parte de los testigos a los cuales se ha notificado que comparezcan el miércoles que viene. 5. Sin que se produzca más en la industria y en la agricultura, cierto es que la situación financiera se empeorará hasta no más. 6. Venga lo que viniere yo le digo a V. que rehusaré de participar en esa empresa, por ser hasta no más peligrosa. 7. Si saliésemos a la misma hora que yo salgo generalmente, llegaríamos a Cádiz antes del anochecer. 8. En su carta se refieren a lo que hemos dicho en nuestra anterior sobre este asunto. 9. Refiriéndome a nuestro contrato de diciembre ppdo. (próximo pasado), les hago a Vs. presente que aun tienen que entregarme trescientas piezas de tela asargada número cuatrocientos veinte y siete (veintisiete). 10. Dijeron que en vista de las pocas existencias del artículo que había en la plaza, habían puesto un telegrama a sus abastecedores diciéndoles que expidiesien todo lo disponible en aquel mercado.

Exercise 36

Translate into Spanish:—

1. My partner died last year, and, according to the terms of our deed of partnership, I had the books balanced, also audited, and handed over to his widow the amount belonging to him. 2. I began the letter so: "Dear Sirs, Whilst enclosing extract of your account, I regret to have to call your attention to the fact that most of the invoices mentioned in it were not paid within the term agreed upon. 3. I came to the office yesterday and found the door closed, for which reason I was obliged to take my order elsewhere, a circumstance which, for your sake, I regret very much. 4. We were summoned to appear and, as witnesses, to declare all that we knew about the matter. 5. Although during the past year three times the usual quantity of goods were produced, there remained an enormous deficit in the National Treasury. To what may this be ascribed? 6. I advise you earnestly to flee from (eschew) such foolish speculations, however enticing the prospectuses of the companies to be floated may be. Of course, they are intended to produce this effect on you. 7. Sleep as long as you like, but adhere to the business hours, come what may. 8. What would you say if a customer asked you to make him an allowance of 50 per cent. because the goods were a trifle off-shade? 9. Please look round your market and send us a wire, telling us what there happens to be in stock.

A. C.

Continued from page 362.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

THE BRITISH ISLES.—V

THE basin of the Thames comprises, in greater or less degree, parts of the counties of Gloucestershire, Wiltshire, Oxfordshire, Berkshire, Buckinghamshire, Hertfordshire, Middlesex, Surrey, Essex and Kent. The country through which it flows is almost purely agricultural, coal is not found in the area, and the size and attractions of London have militated against the growth of towns of any large size.

But for historical interest the towns of the Thames basin can have but few rivals. Oxford, at the junction of the Thames and the Cherwell, is the seat of the other of the two old universities, and the city possesses in its cathedral and college buildings a wealth of ancient architecture unmatched in any city of the kingdom. Windsor, lower down on the banks of the Thames, contains in its famous castle one of the Royal residences, and Eton, on the other side of the river, is noted for its public school.

London and——

The great city of London and capital of the British Empire forms a focus for the whole of the south-eastern portion of Great Britain. From it radiate most of the principal roads and railways of the south-east of England, and the city has become the great distributing centre of the kingdom. On the Thames are enormous stretches of docks, the Port of London extending down the river as far as Tilbury and Gravesend. The chief imports are, perhaps, tea, wool, mutton, sugar, rice, coffee, spices, grain, and timber.

London is also a great manufacturing town and carries on a large trade in sugar-refining, jam-making, the manufacture of soap, candles, matches, leather goods, cement, etc.

The centre of the city proper lies to the north of London Bridge, which was the lowest point on the river where in former times it could be bridged. Here are situated the Bank of England, the Royal Exchange, the Tower and St. Paul's Cathedral. Higner up the stream outside the city boundaries are Westminster Abbey, the Houses of Parliament, the National Gallery, the Palace of Whitehall and Buckingham Palace.

Around London, included in and extending beyond the metropolitan area, is an outer ring of suburbs, largely residential, sometimes referred to as "Greater London" which extends to a distance of about 14 miles in all directions from the centre of the city, and now includes places like Croydon in Surrey, etc., once country villages well beyond the city area.

——Greater London

The total area of "Greater London" is over 690 square miles, and its population is now considerably over seven millions.

Between the London basin and the sea are the south-eastern counties of Kent, Surrey and Sussex. Originally the geological form of these counties was that of a vast arch of chalk which rose up from under the new rocks of the London basin and sank down at about the line of the present sea coast, it having been uplifted along an axis running roughly in an east and west direction. As the crown of this arch became eroded and washed away, the centre is now occupied by older rocks known as the Wealden formation (from the name of the district—the Weald). Thus we have the two broken ends of the old chalk arch projecting in the North and South Downs and these are cut through in gaps by rivers that had originated when the arch was complete, and, as it was worn away, cut lower and lower through what are now the Chalk escarpments.

The Downs themselves are mainly grass covered and given over to sheep rearing. The ends of the Downs reach the sea at Dover and Eastbourne, forming respectively the great chalk cliffs between Dover and Folkestone, and the towering height of Beachy Head. The Weald itself is chiefly

agricultural, having a series of central heights of sandstone formation forming the districts of Ashdown Forest, etc.

Many of the principal towns of the region are situated at or near the gaps made by rivers in the Downs. In Kent, Chatham with its sister town of Rochester is an important garrison town with a naval dockyard; while in Rochester was an important castle now in picturesque ruins, and a cathedral. Canterbury, the seat of the chief archbishopric of the kingdom, is a quaint old city with a cathedral unmatched in historical interest and rivalled by few in architectural beauty. The port of Dover alone among the old Cinque Ports retains its importance, but its harbour is artificial.

The coast is studded with fashionable watering places which extend from Herne Bay, Margate and Folkestone, in Kent, to Hastings, Eastbourne, Brighton, and many others in Sussex. In the centre of the Weald is Tunbridge Wells, a beautiful and fashionable inland watering place with medicinal springs.

The Southern Counties

The southern counties of Hampshire, Wiltshire and Dorset are largely of the chalk formation, with a district, the Hampshire basin, of which the New Forest may be considered the centre, of Tertiary rocks similar to those of the London basin.

In Hampshire are the important ports of Portsmouth (with its naval dockyard) and Southampton at the head of Southampton Water, a long inlet of the sea sheltered by the Isle of Wight. The New Forest, originally planted by William the Conqueror, lies between Southampton Water and the Wiltshire Avon. Bournemouth and the towns of the Isle of Wight are noted winter health resorts with a very mild climate and most luxuriant vegetation.

In the centre of Wiltshire is situated the great upland extent of chalk known as Salisbury Plain.

Salisbury, the county town, has a beautiful cathedral with the loftiest and most graceful spire in the country.

The chalk ends in Dorsetshire, giving place to the oolite formation, and a great part of this county is devoted to dairy farming. None of the towns is of any considerable size, though Weymouth is a watering place of some pretensions.

The south-westerly counties of England form almost a distinct tract of the country and comprise part of Somerset with Devon and Cornwall. The area consists almost altogether of rocks of the older formations with many igneous intrusions such as form the uplands of Dartmoor, the Cornish moors, etc. In Somerset a great deal of the country is in the low-lying basin of the River Parret, and even in historical times must have been a shallow sea studded with islands, of which Athelney was famous as being a place of refuge for King Alfred. The towns of Somerset, if we except Bristol, which is partly situated in the county, are all small agricultural centres.

"Glorious Devon"

Bristol is the most important town of the west of England, being a large port and a fairly large manufacturing centre. The docks are now principally situated at Avonmouth, a few miles down the river at its junction with the Severn estuary, as large vessels cannot come up to the old docks in the city.

The city of Bath is a noted health resort, its hot and medicinal springs being well known to the Romans. Roman remains are plentiful, among them being the old baths, still in good preservation.

Devonshire is purely an agricultural county with the exception of the bare moorland district of Dartmoor. It enjoys a remarkably mild climate and the rich pasturage has rendered famous the dairy products of the county. The south coast is picturesque and possesses many seaside resorts, of which Torquay is the largest. The Dart rises on Dartmoor and is renowned for the beauty of its scenery; at its mouth stands the small port of Dartmouth, which is a training centre for the navy. Dartmoor is treeless except in the valleys, but the country surrounding it is cut up into "coombes" and gorges of remarkable beauty; on the moor itself the granite "tors" are the chief feature, and bogs are numerous. At Princetown in the centre of the moor is a large convict station.

The county town of Devon is the city of Exeter, which possesses a beautiful cathedral and many ancient and picturesque buildings.

Plymouth at the western extremity is one of the chief naval ports of the kingdom, the "Three Towns" of Plymouth, Stonehouse and Devonport forming one large town lining the magnificent harbour which is known as Plymouth Sound at the mouth of the estuary of the Tamar.

The River Tamar divides Devon from Cornwall for the whole of its length. Cornwall is a peninsula largely composed of granite and other igneous rocks, and it was once the most important centre of the tin

THE VALLEY OF THE DART.

A characteristic view (near Ashburton) of the wild beauties of the Devonshire moors.

mining industry in the world. The chief towns are Truro, where there is a modern cathedral, situated at the head of the beautiful estuary of the Fal; Falmouth, a port at the mouth of the same river; Launceston, and Bodmin, the county town. The centre of the china-clay industry is at St. Austell, the product being largely shipped from the small port of Par near by. Redruth and Camborne are the headquarters of the tin-mining industry, the latter town possessing a School of Mines.

The cliff scenery of the coasts of Cornwall is very fine, the cliffs often rising above 200 feet high. At Land's End is the extreme westerly point of Great Britain and the Lizard point is the most southerly part of the British Isles mainland.

Saint Michael's Mount is an isolated granite rock in Mount's Bay crowned by a castle. Penzance, Newquay and St. Ives are well known health resorts and tourist centres.

West of Land's End is the group of the Scilly Isles, five of which only are inhabited. They grow flowers and early vegetables for the London markets.

Wales subdivided

Wales may be subdivided into two or even three parts ; a mountainous northern section, a middle division of uplands where the hills do not rise to so great a height, and the mining and farming region of South Wales.

In the north the country naturally groups itself round the massif of which Snowdon is the culminating point. This mountain, over 3,500 feet high, is the centre of much of the most picturesque portion of the Principality.

The chief towns are Bangor, the seat of a bishop, Carnarvon with its magnificent castle of the time of Edward I., and Conway, which also has a fine ruined castle. There are also many popular seaside resorts, such as Llandudno, Rhyl, and Barmouth at the mouth of the beautiful Mawddach estuary.

The Island of Anglesey is connected with the mainland by a suspension bridge and a railway tubular bridge over the Menai Strait. From Holyhead, a small island at the north-west corner of Anglesey, the Irish mail boats start for Dublin. The chief industries of North Wales are grazing and slate quarrying, the latter being extensively carried on at Llanberis, Festiniog, Bethesda, etc.

Mid Wales centres about the mountain of Plynlimmon, a rounded and grassy elevation which gives rise to the Rivers Severn, Wye, and Teify. The chief industry is sheep farming, and the wool is largely manufactured at Newtown and at Welshpool in the Severn valley. Aberystwyth is a popular resort, and inland are the spas of Llandrindod, etc.

The country, while possessing little of the ruggedness of the northern districts, is in many parts extremely beautiful, the upper Wye valley, for instance, being especially noticeable for its scenery. At Rhayader in this valley is a chain of lakes over 10 miles long, formed by damming the valleys of two streams, and serving as a water supply for the city of Birmingham, 80 miles to the east.

South Wales consists of the mining districts of Glamorganshire, Carmarthenshire with a portion of Monmouthshire (technically in England), and a western agricultural tract.

The Welsh Coalfield

This coalfield is one of the richest in the country, producing especially anthracite and steam coal, which are the kinds most exported. There are many large towns in the district, such as Swansea, Cardiff, Merthyr Tydvil, etc., Cardiff being the largest town in Wales. In the district are large and important iron-smelting works, though the iron is mostly imported ; and considerable tin and copper-smelting industries. In the extreme west the coast is rugged, and on one of the deep inlets, Milford Haven, are the ports of Milford and Pembroke Dock, while Pembroke near by is a smaller port dominated by its ancient castle. St. David's, a small village near the headland of the same name, possesses a beautiful cathedral and the ruins of a bishop's palace.

The whole of this district of Wales is studded with the remains of ancient castles, among which we may mention Caerphilly, Manorbier and Tenby, the latter town being a popular seaside resort.

Wales possesses a university, which is composed of the three colleges of Bangor, Aberystwyth and Cardiff ; and at Lampeter there is a theological college.

The Isle of Man is noticeable chiefly as a holiday resort for the people of Lancashire. A little lead mining is carried on besides cattle breeding and fishing. The principal towns are Douglas, Peel and Ramsey.

The Channel Islands lie off the coast of France, the chief islands being Jersey, Guernsey, Alderney and Sark. The rocks are igneous and the coast very rugged and picturesque. They possess a mild climate and grow early vegetables and fruit for the English market. The small fawn-coloured cattle are noted for the richness of their milk. St. Heliers in Jersey and St. Peter Port in Guernsey are the chief towns. C. J. S.

Continued from page 306.

ART AND MUSIC:

Contributors:—THE THEORY OF ART (Hon. John Collier; J. G. B. Lynch). DRAWING AND PAINTING (J. G. B. Lynch). THE THEORY OF MUSIC (R. R. Terry, Mus.Doc., F.R.C.O.; Hubert Grant).

OIL PAINTING.—II

AMONGST the various indispensable accessories to oil painting may be mentioned a looking-glass. You should have one always in the room in which you are painting, and it should be large and standing upright. You should have this looking-glass put in such a position that you can see both your picture and the object in it at one and the same time.

Corrective of the Looking-Glass

The first important reason for using a looking-glass is that it tells you far better than your eye can whether lines are straight or not. Most painters find that they have a tendency, which lasts for an indefinite period, to paint things crooked. Such an error as this is seen at once and quite definitely in a looking-glass; whereas the eye alone looking direct at the actual picture cannot always detect it. Besides this, a looking-glass gives you a new point of view. It is like looking at the picture with another pair of eyes.

Some authorities believe in "blocking out" the various objects in the picture. This means that straight lines are used everywhere, even for curves. They hold that this is the best way to get shape and position right. In this case you round off angles afterwards in order to put the curves right. There is much to be said for this method. Other authorities think that it is wrong to draw objects in any way different from their ocular presentment. They hold that you should draw what you see. We will take up this attitude as being, perhaps, the safer for the beginner, and observe that curves should always be curves from the outset. Details should be left till the last.

Your first sketch—bear in mind, of course, that you must always use charcoal—should give the principal lines, curves and all. They should be boldly and easily drawn. Make sure that this bold outline is quite accurate before you leave it as finished. Charcoal is easily rubbed out, and there is no particular need to be very sure about your erasure, as there would be in the case of a pencil drawing on paper. Re-draw any lines that you have got wrong and add the minor lines; again be perfectly sure in your own mind that you are right.

There is no reason at all why you should not rule lines which have to be straight. It is foolish to disdain artificial aid so long as it *can* help you.

To brush off charcoal you should use a soft feather brush. And you should always partially erase the charcoal before beginning to paint the picture. The next stage is to trace your lines again, this time with black paint or brown. You should thin this out with turpentine. These lines should not be faint, and they should be of a tolerable width.

The Most Useful Colours

The following are the colours used by the late Sir Lawrence Alma-Tadema: and such a palette can safely be taken as a first-rate example for the use of students. Additions may be made by experienced artists from time to time, but Sir Lawrence's will serve for the moment. The following then should be procured:—Chinese vermilion, ivory-black, cobalt, rose madder, burnt sienna, raw sienna, light red, orange vermilion, flake-white, Naples yellow, yellow ochre.

These will be found enough for most purposes. For some uses, particularly in landscape, you want another yellow for the necessary green. All told, perhaps, pale cadmium is the best colour to use for this. It is quite safe, which chrome, the ideal tint for the purpose, certainly is not. The trouble about chrome is that it will not stand the test of time. It is hopelessly undurable. Raw umber and deep cadmium may be added as being decidedly useful at times, and emerald oxide of chromium is sometimes used with good effect for deep rich greens. It is even used to help in making certain flesh tints. But there is no vital necessity for it. Raw umber is exceedingly convenient for some browns and greys; and deep cadmium is a brilliant yellow of so fine a quality that it seems a pity to leave it out in any category.

With regard to the medium to be used with the colours, a mixture of copal, linseed-oil and turpentine may be recommended. These three should be mixed in equal proportions. But if

you wish your picture to dry very quickly, you should have less linseed-oil, or you may even leave it out altogether. You should have your medium in a little dipper attached to the palette.

Do not on any account stint yourself in regard to brushes. There should be many of them and of all sorts. Flat hog's-hair brushes are those most generally useful. These should vary from about an inch in diameter to a quarter of an inch. You also want a couple of fine sable brushes and what are known as "writer" brushes for lines.

At the first stage of the picture you will only require your larger brushes. But before all things a palette knife is quite indispensable. This should be of horn or ivory. Some people use steel knives, but the metal may affect adversely certain of the colours.

In laying out your colours on the palette, do not think much of waste. You may retrench in various ways, but it is a mistake to do so in this way. You want plenty of colour; and you should avoid trying to paint with the remains of a dab of paint that you have half dry on the palette.

You should always clean your brushes after using them. In this way a great deal of money can be saved, for properly used and constantly cleaned, the life of a good brush is a long one. The method recommended is to put some soft soap in your hand, spread out the brush in this and wash it round until clean. You can rinse it out from time to time in fairly warm water. When you have got rid of all colour, give your brush a last rinse in clean water. This removes the soap. Then you should squeeze it out with a cloth and press back into place any hairs that may be straggling out of place. It is important to keep the brush in its proper shape. Afterwards put it in a warm place to dry.

Importance of Matching Colours

You must now set about the actual painting. The first thing to do is to match your colours. You must get the same tint as the object you are painting and dab the colours on the canvas in the right places, but without any attempt at detail. The spreading out can come afterwards. Take your palette knife and with it mix a tint which faithfully represents some one patch of colour in the object to be copied. When you have got what you think is the right colour, hold it on your palette knife in front of the object and compare them. In this way you can be certain of getting your colours right.

Having dabbed your paint on the canvas, spread it out with a brush until it is of the proper size and shape. You must cover the canvas thoroughly so that it does not show through. Go over the whole canvas in this manner, persevering with the careful spreading of all the important patches of colour that you have to do. After a while you will have your canvas completely covered in this manner. It will be an ungainly spectacle, but that does not matter in the least. The transformation of chaos into form will come later on.

Having completed the day's work put your canvas in the sun to dry, or by a fire. Do not, however, put it too close to the fire or else the oil will bubble up.

The canvas should not be touched again until one whole day at least has passed by. In order to economise time, therefore, it is as well to paint two pictures together, alternately. The difference of subject and treatment also will give your eyes a rest which will be beneficial. Sometimes it is necessary to paint day after day. Then the only means is to paint one part of a picture at a time. But the method is not to be recommended for the student, who should never touch the canvas unless it is quite wet or quite dry.

We will now take it that your picture is perfectly dry and ready for the next treatment. In the first place, rub it all over very gently with linseed oil. If you find that the oil gathers together in some places and will not run (in the same way that oil will not run on a plate) you have only to breathe on the canvas and it will spread readily. You should then take the oil off with a soft brush and you can then go on painting your picture.

Still Life, the Best Practice

You should be content to practice painting from still life until you are quite sure of yourself in portraying a simple object. Do not allow yourself to be tempted away to figures or landscapes or live animals, or indeed anything subject to the least movement. Make still life your practice study until you genuinely feel yourself at home with the palette and brushes.

There is no reason at all why you should get tired of still life. There are innumerable variations—you can paint a picture of almost anything in the room and it is all good practice. The most delightful combinations of colour are to be found in the simplest objects, and a most important part of your training will be in your learning to decide what is good combination of colour, and what will prove to be discordant and clashing.

Thus for the first trial out of doors it is better to choose a house or building, only painting it when the sky is overclouded, and leaving off directly the sun comes out. Once the sun shines the building will be constantly undergoing changes of light and shade and will be beyond the hand of the beginner for successful rendering. After you have tried your hand at fixed buildings and walls, you can turn to trees and shrubs. When you do, paint their general effects from a distance to begin with. These are the most important, and if you come too close you will be puzzled by the extraordinary amount of detail in leaves and branches. Detail is not important for the beginner, who must learn first to render rightly the appearance of tone and tint in a relative degree. Do not paint flowers at first. These are more liable to change than a mass of leaves. The same may be said of distances: which are much affected by the atmosphere. Distant views also bring in the difficult matter of aerial perspective, with which the beginner can hardly be expected to grapple. Remember that the looking-glass you use for still life is just as necessary out of doors. Quite a small hand-glass will serve your purpose. Always try to stand up at your work,

and keep looking at it from such a distance as makes the scene appear the same size as the picture.

When at length you come to the painting of the actual human figure there are two points specially to bear in mind: you must be sure to notice and to render the smallest differences in tints, and you must give the appearance of the right *texture*. The surface of a cast, apart from any question of colour, does not look in the least like human flesh. The right appearance of the texture of flesh is best given by careful painting of the edges. In cast painting the outlines should be sharp everywhere. But the outlines of the human figure are indistinct and very soft, owing largely to the innumerable little hairs with which the smoothest body is covered almost, though not entirely. So that the outline of some parts of the figure is necessarily sharper than others. Skin is also partly transparent and that fact makes edges soft too.

How to Apply Colour

Colouring in some places such as the cheek, is broken up even in the case of the best and purest skins. So it must be painted accordingly. Put on the colours separately and leave them to *look* separate. Paint is laid on roughly where a wrinkled appearance is required. In the first application of colour draw your brush in the direction of such wrinkles in the skin as you may see. This in itself will give the look of the real texture. Put in the hair with a large brush first of all. Use it lightly to indicate the way in which the hair lies. This is largely a matter of practice. Later when you come to finish off your picture you can put in a stray hair here and there with a writer brush. But only put in those which can be seen clearly from a distance.

The difficulties of flesh tints are innumerable and only a few general hints can be given here in writing. Most learning worth the name comes from experience, and the experience of the master you work under will be at your disposal. Much you can teach yourself by sheer observation. But a deal of time and trouble will be saved if you follow out general rules implicitly, and work steadily under a good man.

The next point to study is that of draperies—a most difficult and complicated branch of the art; but if well done, a highly satisfactory one. Drapery is a subject which may well be introduced into your still-life work. A curtain, or a cloak lying over a chair or any such combination will give you excellent practice. You must study the folds of whatever the stuff happens to be and the best of all ways for doing so is with a lay figure. It is not the same thing, of course, as the study of drapery in the living model. But the difficulties of a subject of such a kind are too much for the beginning student to undertake. You should vary your material on the lay figure as much as you can. Try drawing every sort of stuff, because each sort falls into different kinds of fold. Silk has one kind, muslin another, hard tweed naturally falls stiffer and straighter than the first two. But you will have to attempt all of these sooner or later if you wish to be a portrait painter. You cannot hope to give the right appearance of the texture without studying the peculiar characteristics of the folds. You can practice the drawing and painting of any kind of fold from the lay figure, and you should persevere with it until you have mastered every possible kind you can think of. Gradually you will find that you can work quicker and quicker at the still draperies, until you can do them in the comparatively short time for which a living model can keep quiet and still. Then you can try your hand at draperies on the living model. You cannot work successfully at the living model without first going through the full time of apprenticeship with the lay figure.

It is necessary for the painter of the human figure to have some rudimentary knowledge of anatomy. But this knowledge will not make up for lack of direct observation of the living model, and studies from the antique will serve your purpose better than practice from the living model alone. Superficial knowledge, that is to say, absolute knowledge of the surface of the human body, is enough for the purposes of any painting or sculpture if it *is* absolute and exhaustive. We have only to remember the Greeks to know that. No one since the days of Praxitéles has shown better knowledge of the human frame, and it is exceedingly doubtful whether Praxitéles had a first-rate knowledge of anatomy as we understand the word.

Portrait-painting

Anatomy is most useful when you wish to convey the impression of the human form in movement. For this a knowledge of the way in which muscles work is almost essential. But you must never let your knowledge take precedence of your observation. Paint what you see, otherwise you will be liable to make the mistake a child makes when drawing a profile of a face, and put in two eyes because he *knows* there are two eyes in a face—and lets this knowledge give the lie to his own eyes which see only one. Leonardo described figures, which were painted with every muscle showing, as looking like a bag of walnuts. Such a figure is not a work of art but a scientific diagram. This is an effect which you must studiously avoid.

The next stage is actual portrait-painting. The standard of accuracy here must necessarily be extremely high. You may, with a fair amount of ease, paint a flower vase or an old house in such way as they shall be recognisable. But in order to paint a man's face, so that all his acquaintances shall recognise it as his face, is another matter altogether. You have to be *perfectly* accurate in all essentials and details as well. And even when you have arrived at that standard of proficiency you have won only half the battle. For in order to give a true portrait, it is not sufficient merely to get the lines and details, tones and tints accurate: you must also present *character* and expression. This will, of course, be beyond the sphere of the beginner, and can only be attempted by the accomplished artist.

The student will do well, however, to content himself at first with simple portraiture, painting his sitter as he or she appears at the moment. Try to get a good likeness.

J. G. B. L.

Continued from page 371.

MATHEMATICS:

Contributor : — ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.
(M. A. Lewenz, M.A.[Lond.]).

HYDROSTATICS.—IV

30. **Pneumatics.**—Most of what has been said about liquids in the preceding lessons is true also of gases.

Gases also transmit pressure equally in all directions, owing to the mobility of the particles of which they are composed; they have weight, and hence, like liquids, they cause bodies immersed in them to lose weight equal to that of the volume of gas displaced; and if the bodies be very light they will float in gas. Gases differ from liquids in that they may be compressed into any volume however small (until they become liquid), and that they expand to fill any volume however large it may be.

This was pointed out in the first lesson. (*See* p. 232, § 2.)

31. **The Air** is a mixture of gases, the main constituents being oxygen and nitrogen, together with a small quantity of carbon-dioxide and traces of other gases. That air has weight may be shown in the following way: A large glass flask, fitted with a stopcock, is completely exhausted of air by means of an air pump, and the tap is closed. The flask is then hung on the arm of a balance and the weight noted. The tap is opened, and the air rushes into the flask, and immediately the beam of the balance dips, showing that the flask is heavier than before. If now the weight of the flask containing air be noted, and the volume of the flask be known, the density of the air may be found, and its specific gravity. If W′ = weight of flask when empty of air and W = weight of flask when full of air and V = volume of flask, then clearly the density $D = \frac{W - W'}{V}$.

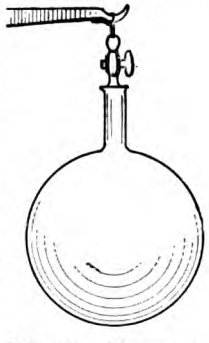


Fig. 20.—To ascertain the density of air.

Gases vary in weight, and many are lighter than air. This is made use of in balloons and airships. Some envelope made of silk or light metal is filled with a gas lighter than air, and a car for passengers is attached below it. Then the forces acting on the airship consist of the weight of the ship and the contained gas acting vertically downwards on the one hand, and the weight of the displaced air acting vertically upwards on the other hand.

As the gas-bag, or envelope, is always very large compared with the size of the car, the result of the upward pressure is that the airship floats in the air, just as solids float in water and other liquids.

Torricelli's Experiment.

Take a glass tube about 33 or 34 inches long and open at one end, and fill it completely with mercury.

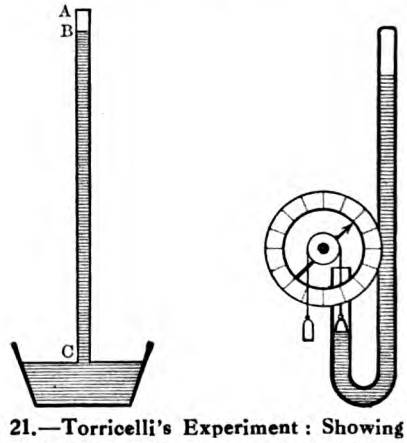


Fig. 21.—Torricelli's Experiment: Showing the principle of the mercury barometer.

Place the thumb over the open end and invert the tube with this end into an open vessel containing mercury. Remove the thumb, taking care that no air gets into the tube. The mercury in the tube will at once sink, leaving an empty space A B at the top; it will then become stationary, and it will be found that the height of the column of mercury B C above the free surface of mercury in the vessel is about 30 inches, or 760 millimetres.

The space above the mercury A B is known as the

Torricellian Vacuum.

The downward pressure of the air on the free surface of the mercury in the vessel balances the pressure of the column of mercury in the tube; hence the latter measures the pressure of the air. An apparatus of this kind furnished with a scale for reading the height of the mercury column is called a **Mercury Barometer.** The height of

the column, which, of course, varies as the pressure of the atmosphere varies, is called the **Barometer Reading.**

In the accompanying figure the height of the column of mercury is the difference of height in the two tubes, and the motion of the mercury in the short open part of the tube is used as an indicator of the height, by means of a float counterpoised over a pulley with an index.

Barometers are also made in which water and glycerine are used instead of mercury; the latter is the most sensitive.

The **Aneroid Barometer** consists of a hollow metal box exhausted of air. It has a thin lid supported by a spring against the weight of the atmosphere. As atmospheric pressure increases or decreases, the lid sinks or rises and moves a pointer which indicates the pressure on a dial.

Since changes in the weather are usually preceded by changes in atmospheric pressure, the barometer is used to foretell such changes.

Corrections of the Barometer.

(1) *Correction for Temperature.*—Since a column of mercury measuring 760 mm. at 0° C. will be found to have a greater length at a higher temperature, if barometric heights at different places and at different temperatures are to be compared, the observed height in each case must be reduced to the height that the same pressure produces at a given temperature—usually 0° C.

(2) *Correction for Capillarity.*—When the tube containing the mercury is very narrow, the surface of the mercury will be curved instead of horizontal. This phenomenon is known as capillarity, and allowance must be made for the consequential difference in the reading of the height of the column.

(3) *Correction for Difference of Sea Level.*—The density of air varies, owing to its compressibility, at different heights, but even if the air were of uniform density, its pressure at a low level would obviously be greater than that at a high level. When readings at different altitudes are to be compared, they must therefore be reduced to readings at the same level. In practice, the difference in barometric readings is often used to determine differences of altitude.

(4) *Correction for Variations in the Intensity of Gravity.*

Since the value of g varies at different points of the earth's surface, the reading of the barometer will vary correspondingly, and must be corrected. The standard usually taken is the value of g at sea level latitude 45°.

The average height of a mercury barometer is 30 in., or 760 mm. This corresponds to a height of 34 ft. in a water barometer and is equivalent to a pressure of about 14·7 lb. per sq. in. Such a pressure is called **one atmosphere.**

32. Boyle's Law.

This indicates the relation between pressure and the volume of a gas, when the temperature remains constant. It runs as follows:

The volume of a given mass of gas is inversely proportional to the pressure when the temperature remains constant.

Thus if at a pressure P the volume of a gas be V

Then at a pressure P_1 the volume of the gas $= \frac{P}{P_1} V$

and at a pressure P_2 the volume of the gas $= \frac{P}{P_2} V$

and so on.

And since $P \times V = P_1 \times \frac{P}{P_1} V = P_2 \times \frac{P}{P_2} V \ldots .$

it follows that

the product of the pressure and the volume of a given mass of gas is constant, when the temperature remains constant.

For if at a pressure P, the volume = V, and at a pressure P_1 the volume = V_1, then by Boyle's Law

$$\frac{V}{V_1} = \frac{\frac{1}{P}}{\frac{1}{P_1}} = \frac{P_1}{P} \text{ i.e. } V \times P = V_1 \times P_1$$

Boyle's Law may also be stated in the following manner:

The pressure of a gas is proportional to its density when the temperature remains constant.

For if m = mass of gas and D and D_1 its densities when its volumes are V and V_1, then

$$D = \frac{m}{V}, \qquad D_1 = \frac{m}{V_1}$$

$$\text{Hence } \frac{P}{P_1} = \frac{\frac{1}{V}}{\frac{1}{V_1}} = \frac{\frac{m}{V}}{\frac{m}{V_1}} = \frac{D}{D_1}$$

Experiments to verify Boyle's Law.

(1) For pressures greater than that of the atmosphere.

Take a **U** tube having one branch open at the end and longer than the other, which is either hermetically closed or fitted with an airtight cap with a tap, by means of which pressure can be regulated.* The branches of the tube are graduated or have a scale affixed to them. Pour a little mercury into the tube so that it reaches the point marked zero on each scale. Fix on the airtight cap A, then from O to A the tube will be filled with air at the ordinary atmospheric pressure of 760 mm. Pour more mercury in through the open end of the tube; the mercury level will be higher in the longer branch than in the shorter. The volume of air in the shorter branch is diminished, and the pressure on it is increased by the weight of the column of mercury C B.

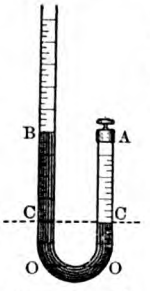


Fig. 22.—To verify Boyle's Law.

Suppose the air to have originally occupied 100 mm. of the tube, and that the mercury in the longer branch stands at a height of 270 mm. above its former level. Then the mercury in the shorter branch will stand at a height 20 mm. above 0, con-

* This is known as a Boyle's Law tube.

sequently the air will occupy a space of 100 — 20 = 80 mm. only. The increase of pressure due to the difference in level of the mercury will consequently be 270 — 80 = 190 mm.

Now we find that

100 : 80 : : 190 + 760 : 760

i.e. 100 : 80 : : 950 : 760

or $100 \times 760 = 80 \times 950$

i.e. $V_1 \times P_1 = V_2 \times P_2$

or the volume varies inversely as the pressure.

(2) For pressures less than that of an atmosphere.

Take a barometer tube fitted with a cap and screw at one end and immerse it partially in a vessel containing mercury, leaving the top open so that the mercury is at the same level in tube and vessel. Then close the top, thus leaving air at ordinary atmospheric pressure in the top of the tube. If now the tube be drawn upwards the mercury will fall in the tube, although it will be at a higher level than that in the vessel. The enclosed air will expand, as the pressure will be lessened by the weight of the column of mercury in the tube above the level of the mercury in the vessel.

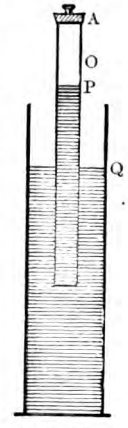


Fig. 23.—To verify Boyle's Law.

Thus if the tube be originally immersed as far as O and then drawn upwards as in the figure, then the air which originally occupied A O will now occupy A P, while the pressure will be less than that of the atmosphere by the weight of the column of mercury P Q.

Here again if readings be taken on scales, it will be found that the volume varies inversely as the pressure.

33. Limits of Boyle's Law.

Boyle's Law is formulated for perfect gases. It is approximately true for such gases as do not easily liquefy under pressure. But gases which liquefy at a comparatively low pressure do not conform to Boyle's Law, and the more nearly they approach the point of liquefaction the more do they diverge from the law.

34. Examples :—

(1) A gas occupies 100 litres when the barometer stands at 76 cm. Find the increase in volume when the barometer stands at 70 cm.

$V_1 P_1 = V_2 P_2 \therefore 100 \times 76 = V_2 \times 70$

whence $V_2 = \frac{760}{7}$ litres = 108·57 litres.

Hence increase in volume = $V_2 - V_1$ = 8·57 litres.

(2) A bubble of air rises from the bottom of a pond and its diameter has increased by one half when it reaches the surface. Find the depth of the pond.

Volume of bubble (which is a sphere) = $\frac{4}{3}\pi r^3$

$= \frac{1}{6}\pi$ (diameter)^3 i.e. volume varies as the cube of the diameter.

Hence volume at surface = $\frac{27}{8} \times$ volume at bottom. Consequently by Boyle's Law

Pressure at surface = $\frac{8}{27}$ pressure at bottom.

Now pressure at surface = pressure of 1 atmosphere

$\therefore$ pressure at the bottom = $\frac{27}{8}$ atmospheres.

Now, taking the height of the water barometer as 34 ft., the pressure in the pond increases by 1 atmosphere for every 34 ft. of depth.

Now difference between pressure at bottom and at surface = $\frac{27}{8} - 1 = \frac{19}{8}$ atmospheres.

Therefore depth of pond

$= \frac{19}{8} \times 34 = \frac{323}{4} = 80\frac{3}{4}$ ft.

Exercise 6

(1) Gas is sold by the cubic foot, but the illuminating power is proportional to the mass burnt per hour. A 15-candle-jet power costs 1d. for six hours when the barometer stands at 30 inches. What will it cost for the same candle power in the same time when the barometer is at 28 inches? (Neglect the difference in pressure between the gas and the atmosphere.)

(2) The mercury in the bend of a Boyle's Law tube reaches to the same level in both limbs. The tube is 1 sq. cm. in cross section and the mercury surface in the closed limb is 3 cms. from the top. Mercury is poured into the open limb until the surface in the closed limb has risen 1 cm. Find how much mercury is required if the barometer stands at 76 cms.?

(3) Assuming that a gramme of air occupies 773 c.c. under the atmospheric pressure (equal to 30 inches of mercury of density 13.6), find the depth below water to which an air bubble would require to be immersed before its density became equal to that of water.

(The above questions are from the London Matric. Exam.)

Key to Exercise 4

(1) ·875. (2) 2·8. (3) 4 : 1 by vol.; 140 : 29 by wt. (5) 15·2.

Key to Exercise 5

(1 12·5 oz. (2) 3. (3) 70·6 approx.

M. A. L.

MENSURATION.—V

46. Frustra.

Let A B C . P Q R be a frustrum of a cone O . A B C.

Let N M = height of frustrum = h.
Let O M = height of cone O . A B C = y.
Let O N = height of cone O . P Q R = z.
Let P A = slant side of frustrum = l.
Let O A = slant side of cone O . A B C = d.
Let O P = slant side of cone O . P Q R = e.
Let B M = radius of base = r.
Let Q N = radius of top = r'.
Let A = area of base = πr^2.
Let A′ = area of top = $\pi r'^2$.

Curved surface of frustrum

= curved surface of O . A B C
— curved surface of O . P Q R.
$= \pi rd - \pi r'e = \pi [r(l + e) - r'(d - l)].$
$= \pi [rl + re - r'd - r'l].$
Now $\triangle$s B M O, Q N O are similar.
$\therefore \frac{BM}{BO} = \frac{QN}{QO} \therefore \frac{r}{d} = \frac{r'}{e} \therefore re = r'd.$
$\therefore$ curved surface of frustrum
$= \pi l (r - r') = \frac{1}{2}$ ***sum of circumferences of top and base*** $\times$ ***slant side.***

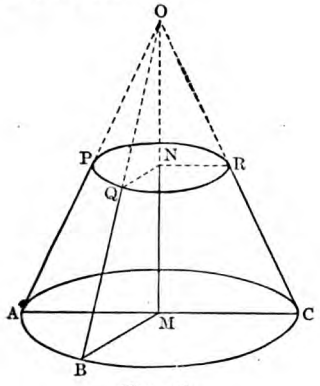


Fig 48

Volume of frustrum

= vol. of O . A B C — vol. of O . P Q R
$= \frac{1}{3}\pi \frac{r^3}{\tan\alpha} - \frac{1}{3}\pi \frac{r'^3}{\tan\alpha}.$
$= \frac{\pi}{3\tan\alpha}(r^3 - r'^3) = \frac{\pi}{3\tan\alpha}(r - r')$
$(r^2 + rr' + r'^3).$
Now $\frac{r}{r'} = \frac{y}{z} \therefore r - r' = (y - z)\frac{r'}{z} = (y - z)$ tan α.
$\therefore$ vol. of frustrum $= \frac{\pi}{3}(y - z)(r^2 + rr' + r'^3).$
$= \frac{1}{3}(\pi r^2 + \pi rr' + \pi r'^3)\, h.$
$= \frac{h}{3}(A + \sqrt{AA'} + A').$

47. Frustrum of a pyramid.

By choosing $\pi r^2 = A$ = area of base of frustrum, and $\pi r'^2 = A'$ = area of top of frustrum, we have volume of pyramid = volume of cone of same height on base of equal area, and hence

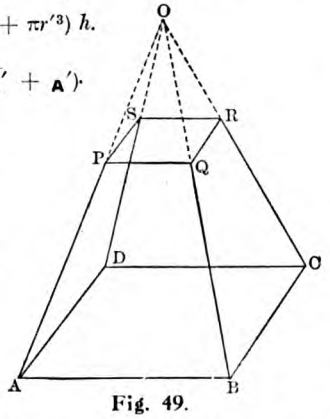


Fig. 49.

Volume of frustrum = volume of frustrum of cone of same height $= \frac{h}{3}(A + \sqrt{AA'} + A')$.

Each side face is a trapezium.
Let successive edges A B_1 B C_1 . . . . $= a_1, a_2, a_3$ . . . .
Let successive edges P Q_1 Q R_1 . . . . $= b_1, b_2, b_3$ . . . .
Let slant side P A = Q B = ... $= l_1, l_2, l_3$ . . . .
Then **total area of sides**
$= \frac{1}{2}(a_1 + b_1)\, l_1 + \frac{1}{2}(a_2 + b_2)\, l_2 + \ldots\ldots$
For a **regular pyramid** $l_1 = l_2 = \ldots\ldots = l$.
$\therefore$ **total area of sides** $= \frac{l}{2}(a_1 + b_1 + a_2 + b_2 + \ldots\ldots)$.

48. Definition. A wedge is a triangular prism in which the two ends are not necessarily parallel.

Let a_1, a_2, a_3 be the lengths of the edges A B, C D and E F, of which A B is the shortest.
Let two planes $\perp$ to these edges make triangular sections of equal area S.

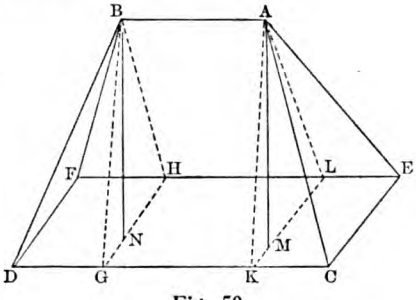


Fig. 50.

Let A M = B N = height of wedge = h.
Let G H = K L = b.
Let D G = y_1, K C = x_1.
Let F H = y_2, L E = x_2.
Vol. of pyramid A . K C E L = $\frac{1}{3}h \times$ area of K C E L
$= \frac{1}{3}h \times \frac{1}{2}(x_1 + x_2)b.$
$= \frac{x_1 + x_2}{3} \times \frac{hb}{2} = \frac{1}{3}(x_1 + x_2)$ S.
Volume of prism B A . G H L K $= a_1 \times$ S.
Volume of pyramid B . D G H F $= \frac{1}{3}(y_1 + y_2)$ S.
$\therefore$ **volume of wedge** $= \frac{S}{3}(x_1 + x_2 + y_1 + y_2 + 3a_1).$
$= \frac{S}{3}(x_1 + a_1 + y_1 + x_2 + a_1 + y_2 + a_1).$
$= \frac{S}{3}(a_1' + a_2 + a_3).$
$=$ **area of perpendicular cross section $\times$ mean length of edge.**

If the wedge be placed with its parallel edges upright, **vol = area of perpendicular cross section $\times$ mean height.**

49. Definition.

A sphere is a solid figure bounded by a single curved surface, every point on which is equidistant from a fixed point within the figure, called the centre.

The lines drawn from the centre to the surface are called **radii.**

The following properties of a sphere are obvious:
(1) The section of a sphere by any plane is a **circle.**
(2) All **great circles** of a sphere are equal. A

great circle is the section of a sphere by a plane through the centre.

Such a plane is called a **diametral plane.**

Sections of a sphere by other planes are called **small circles.**

A spherical shell is a solid figure contained by two spherical surfaces which are concentric.

A frustrum of a sphere is the part of a sphere intercepted by two parallel planes.

The curved surface of a frustrum is called a **zone.**

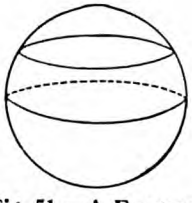


Fig. 51.—A Frustrum.

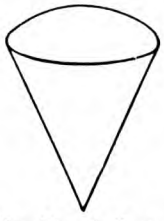


Fig. 52.—A Sector of a Sphere.

A sector of a sphere is the solid figure enclosed by that portion of the surface of a sphere which is cut off by a plane and the conical surface which has the small circle of the section of the sphere by the plane as base, and the centre of the sphere as vertex.

The ends of a diameter perpendicular to the plane of any great circle are called the **poles** of that great circle.

50. *To find the surface of a sphere.*

Clearly a sphere may be generated by a semi-circular area revolving round its bounding diameter.

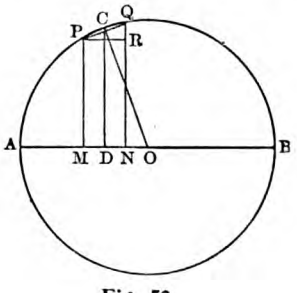


Fig. 53.

Let Q B A be such a semi ○, P Q a small arc of it of which P Q is the chord.

Then the zone of the sphere generated by the revolution of the chord P Q = the frustrum of a cone, with slant side P Q and axis A O.

When the arc is made infinitesimally small, the arc P Q and the chord P Q are identical. Hence under these conditions we may say that the revolution of the infinitesimal arc P Q generates a frustrum of a cone of slant side P Q and axis A O.

Bisect P Q at C and draw O C. Draw C D ⊥ to A O.

The curved surface of the frustrum generated by $\text{P Q} = \pi \cdot \text{P Q} \cdot (\text{Q N} - \text{P M}) = 2\pi \cdot \text{P Q} \cdot \text{C D}$, where Q N, P M are ⊥ to A O.

Draw P R ⊥ to C N. Then △s P Q R, C O D are similar.

$\therefore$ P Q : P R = C O : C D.

$\therefore$ P Q . C D = C O . P R.

$\therefore$ curved surface of frustrum $= 2\pi \cdot \text{C O} \cdot \text{P R} = 2\pi \cdot \text{C O} \cdot \text{M N}$.

But in the limit C O $= r =$ radius of sphere.

$\therefore$ in the limit curved surface of zone of sphere $= 2\pi r \cdot \text{M N}$.

Now if a succession of small chords P Q be taken (so small that they coincide with the arcs) so that their sum constitutes the semi-circumference A P B, then the sum of their projections M N will = diameter A B $= 2r$.

Now surface of sphere = sum of all zones generated by the revolution of the small arcs P Q.

$\therefore$ **surface of sphere** $= 2\pi r \times 2r$.

$= \mathbf{4\pi r^2}$.

COROLLARY 1. *The area of any zone is proportional to its height.*

For the area of the zone described by any arc P Q $= 2\pi r \cdot \text{M N} \cdot = 2\pi rh$.

COROLLARY 2.—*If the sphere be fitted into a hollow cylinder which will just hold it, and whose height equals the diameter of the sphere,* then the sum of the areas of the ends of the cylinder $= 2\pi r^2$ and area of curved surface $= 2\pi r \times 2r$. $= 4\pi r^2$.

$\therefore$ total surface area of cylinder $= 6\pi r^2$.

Hence **surface area of a sphere** $= \frac{2}{3}$ **surface area of circumscribing cylinder.**

COROLLARY 3.—*To find the surface area of a spherical sector.*

Let h = height of spherical cap of sector.

Then $r - h$ = height of conical base of sector and r = length of its slant side.

$\therefore$ **radius of conical base**

$= \sqrt{r^2 - (r - h)^2}$

$= \sqrt{h(2r - h)}$.

Hence curved surface of conical base $= \pi r \sqrt{h(2r - h)}$.

And by Corollary 1 surface of cap $= 2\pi rh$.

$\therefore$ **surface area of sector**

$= 2\pi rh + \pi r \sqrt{2h\,(r - h)}$.

$= \pi r \left\{ \mathbf{2h} + \sqrt{\mathbf{2h(r - h)}} \right\}$.

51. *To find the volume of a sphere.*

On the surface of the sphere take any small area A. If this is small enough it may be considered a plane. By connecting its boundaries with the centre O we get a pyramid of height $= r$, the radius of the sphere.

Now vol. of pyramid $= \frac{1}{3}$ area of base $\times$ height. $= \frac{1}{3}$ area A $\times r$.

But the sum of the volumes of all such pyramids make up the volume of the sphere, and the sum of all such areas A make up the surface of the sphere.

Hence **volume of sphere**

$= \frac{1}{3}$ surface of sphere $\times r$.

$= \frac{1}{3} \times 4\pi r^2 \times r$.

$= \frac{4}{3}\pi r^3$.

COROLLARY 1.—*To find the volume of a sector of a sphere.*

If the area of the polar cap be divided into small areas as above, then volume of sector = sum of volumes of pyramids with bases on polar cap and vertices at centre of sphere.

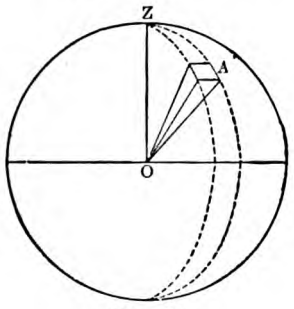


Fig. 54.

But volume of pyramid = $\frac{1}{3}$ area of base × height, and the sum of the areas of the bases = area of cap. $= 2\pi rh$,

where h = height of cap.

$\therefore$ volume of sector $= \frac{2}{3}\pi rh \times r = \frac{2}{3}\pi r^2 h$.

(*See* Fig. in Cor. 2.)

COROLLARY 2.—*To find the volume of a segment of a sphere.*

Vol. of segment = vol. of sector — vol. of cone.

$= \frac{2}{3}\pi r^2 h - \frac{1}{3}\pi r_1^2 (r - h)$,

where r_1 = radius of small circle forming base of segment = C P

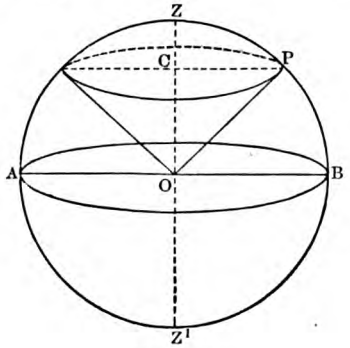


Fig. 55.

and h = Z C.

Now r_1^2 = C P^2 = $h(2r - h)$.

$\therefore$ **volume of segment**

$= \frac{2}{3}\pi r^2 h - \frac{1}{3}\pi h (2r - h)(r - h)$.

$= \frac{\pi}{3} h (2r^2 - 2r^2 + 3rh - h^2)$.

$= \frac{\pi}{3} h^2 (3r - h)$.

COROLLARY 3.—*To find the volume of a frustrum of a sphere.*

Volume of frustrum P Q R S

= vol. of segment Z S R — vol. of segment Z P Q.

$= \frac{\pi}{3} h^2 (3r - h) - \frac{\pi}{3} k^2 (3r - k)$,

where Z D = h and Z C = k.

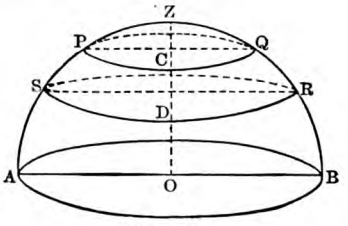


Fig. 56.

$\therefore$ **volume of frustrum** $= \pi r (h^2 - k^2) - \frac{\pi}{3}(h^3 - k^3)$.

Exercise 3

Find the surface area of

(1) A cube. (2) A regular tetrahedron. (3) A regular octahedron. (4) An icosahedron; the edge in each case being l.

(5) How many sq. ft. of iron will be required to make a tank (without a lid) 12 ft. long 10 ft. broad and 6 ft. high. How many cubic ft. of water would such a tank contain?

(6) Find the surface area of a pyramid whose base is a regular hexagon each of whose sides = 6 ft. and whose slant height is 2 ft.

(7) Find the volume of the figures in questions 1—3.

(8) Show that the diagonal of a rectangular block whose edges are a, b and $c = a^2 + b^2 + c^2$.

(9) Find the height and volume of a pyramid on a square base of side 40 metres if its faces are inclined at an angle of 45° to the base.

(10) Find the volume of a frustrum of a square pyramid, the height of the frustrum being 9 in. and the sides of the square ends 5 in. and 8 in. respectively.

(11) What is the volume of a cylinder 14 ft. high and 6 ft. in diameter?

(12) What is the volume and total surface area of a cone 12 in. high the radius of whose base is 5 in.?

(13) The cross section of a wedge is an equilateral triangle of edge 5 ft.; the lengths of the parallel edges are 20 ft., 24 ft. and 10 ft. What is its volume?

(14) Find the diameter of a hemispherical bowl to hold 10 gallons.

(15) Find the surface area of a sphere of radius 2 yards.

(16) A conical cap the radius of whose base is 9 cm. just fits on a sphere of radius 15 cm. How much of the surface of the sphere is covered?

(17) A right circular cone of semi-vertical angle 30° and height h has a sphere inscribed in it. What is the volume of the cone outside the sphere?

Key to Exercise 3

(1) 6 l^2. (2) $\sqrt{3}l^2$. (3) $2\sqrt{3}l^2$. (4) $5\sqrt{3}l^2$. (5) 384 sq. ft.; 720 cb. ft. (6) $(36 + 18\sqrt{3})$ sq. ft. (7) l^3; $\frac{l^3}{6\sqrt{2}}$; $\frac{\sqrt{2}}{3}l^3$. (9) h = 20 metres, vol. = 10670 cb. metres. (10) 387 cb. in. (11) 396 cb. ft. (12) $314\frac{2}{7}$ cb. in.; $282\frac{6}{7}$ sq. in. (13) 195 cb. ft. nearly. (14) 21·96 in. (15) $50\frac{2}{7}$ sq. yds. (16) $282\frac{6}{7}$ sq. cm. (17) $\frac{5\pi h^3}{81}$.

M. A. L.

Continued from page 376.

BUSINESS AND COMMERCE:

Contributors :—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).

COMMERCIAL TRAINING.—XLI

THE laws and customs of bankruptcy should be known to all business men, not necessarily because they are likely to become bankrupts themselves, but in order that they may know the procedure in the event of a customer or business acquaintance falling on bad times.

Briefly, the object of a state of bankruptcy officially is to place all creditors upon an even and equal footing ; so that one creditor may not benefit from the assets of a bankrupt to a greater extent proportionately than another. What actually occurs, is that the bankrupt comes forward, places his assets as it were upon the table, and leaves the apportioning of his belongings among the creditors to the officials of the court.

Becoming Bankrupt

In fact, from the time the petition is presented, the estate of the bankrupt is administered entirely by the official receiver, appointed by the Board of Trade ; at least, until a trustee can be placed in office.

Practically speaking, the initial cost of becoming a bankrupt is £5, which must be paid by the person lodging the petition—in a great many instances the bankrupt himself. At the same time the petition may be presented by a creditor, the latter being then known as the petitioning creditor. There is a minimum sum that must be owed before bankruptcy proceedings may be instituted, in most circumstances £50.

The petition is presented to the court, then, either by the petitioning creditor or by the bankrupt himself ; and here it may be explained that so far as the metropolis is concerned bankruptcy business is dealt with at one of the Law Courts, though in the country the work is done at the county courts. The person presenting the petition is called to give proof of the various statements he makes ; and, as a result, the court issues a Receiving Order against the estate of the bankrupt.

The effect of this order is that an official receiver becomes not only the receiver, but also the actual protector of the property until the various creditors can meet together and appoint a trustee to act on their behalf.

The next step is for the bankrupt to furnish to the official receiver a full statement of his affairs ; and, by law, this matter must be completed within seven days of the making of the receiving order. Later on the debtor is called upon to attend at the court and to undergo a public examination, when all the statements he has given to the receiver have to be made on oath. Following upon this the official receiver is called upon to make his report as to the truth and reliability of the debtor's statement ; and the nature of this report has much to do with the eventual discharge of the debtor from his bankruptcy.

Creditors' Meeting

Within a period not exceeding fourteen days from the making of the receiving order a meeting of the creditors is convened ; and, at this meeting, the various claims are closely considered and afterwards a decision is arrived at as to whether the debtor shall be made an actual bankrupt, or whether the creditors will accept from him some arrangement for the settlement of his debts.

In the case of the meeting deciding for actual bankruptcy, a trustee is appointed by the creditors ; or, in some instances, by the Board of Trade, and the whole of the property of the debtor of a personal and realisable character is sold. Then the proceeds, less the expenses incurred, are divided among the creditors in proportion to the amounts owing to them, a dividend at so much in the pound being paid.

On the other hand, it may be that the debtor is able to offer a composition of so much in the pound upon his debts and to

make an arrangement to this effect with his creditors.

Generally speaking, when a reasonable dividend has been paid to the creditors, and the debtor can prove that he has kept his accounts clearly and has not been foolishly extravagant or speculative, the court will grant his discharge from bankruptcy. It should be pointed out, however, that until a bankrupt receives his formal discharge he does not possess the right of trading in the ordinary way; and one of the difficulties under which he must labour is that he is not allowed by law to accept credit in excess of £20, without actually disclosing at the time that he is an undischarged bankrupt. In fact, to accept credit without making the disclosure would render him liable to imprisonment for a criminal offence.

Directly a petition for bankruptcy is lodged by one creditor, the other creditors are debarred from pursuing legal action against the debtor; and it is the duty of every creditor of a bankrupt to come forward with proof as to his debt as speedily after the making of the receiving order as possible, being willing also to make an affidavit as to the genuineness of the debt.

The mere fact of a debtor fleeing the country, or in any way placing himself completely out of touch with the creditors, does not stop bankruptcy proceedings; in fact, such conduct may be said to hasten the proceedings. In some cases, where the total debts do not represent a particularly large sum, according to the circumstances of the matter the court is empowered actually to order the payment of the debts on a system of instalments.

A Bankrupt's Discharge

Following upon the discharge of a bankrupt, he is automatically released from all debts that were actually proved at the time in the court; but he is in no circumstances released from debts owing to the Crown. In many instances the discharge is not granted immediately, but is suspended for a year or two years, as the case may be. The suspension of discharge is usually due to some suggestion of rashness or extravagance, the destruction of books of account, to trading beyond the period when insolvency was made plain, and such matters; and an undischarged bankrupt labours under serious disabilities among those who are untrammelled, particularly in business circles. And it may be mentioned also that it is a criminal offence for an undischarged bankrupt to attempt to trade under an assumed name, without disclosing the fact that his discharge has not been granted.

The law of the land as applied to partnership is embraced very largely in the Partnership Act of 1890, and describes partners as "persons carrying on a business in common with a view to profit." It will be obvious, then, that the common possession of property or the mere drawing of a share of profits does not constitute legal partnership. And the point is made still clearer by the Act, which tells us that in cases where a debt is being paid by instalments from the profits of a business, the creditor is in no sense a partner; nor is an employee when he is partly remunerated by a percentage of the profits of a business.

Again, the widow or other dependents or legatees of a deceased partner who draw annuities or allowances from the business are not legal partners; nor is a man who has sold a business to others and receives payment for the goodwill in the shape of annuities or regular payments from the profits.

What is Partnership?

This question of partnership and its exact definition is of even greater importance than may appear at first glance, for it must be remembered that a legally constituted partner is responsible for the debts of the firm, and the actions of fellow partners in the business.

There is no need to have documents to make a partnership legally binding. Partnership (i.e. the act of working with others with a view to profit) is at law a contract between two or more persons. It may be a contract in writing, or merely verbal; and it may be non-existent except in theory, for two people may be in business together, divide the profits, and be only partners by inference.

An active partner is one actually engaged in the conduct of a business; a sleeping partner is one who has provided monetary capital for the conduct of the business but takes no actual part in it. Even though he does not appear and may not be known in a public way, a sleeping partner is equally responsible with the active partner for the debts and other liabilities of the firm; and, just as one partner is an agent for the others and for the firm, so are all held to be responsible.

Partnership ends automatically with the death or bankruptcy of one of the partners; or it may be dissolved by agreement among the partners. In other circumstances, it expires at the termination of a fixed period or by notice, according to plan. A. B.

CHOOSING A CAREER.—XLVI

Tinplate Workers.—The Swansea district of South Wales is an important centre in the tinplate trade, but tinplate workers are to be found in most parts of the country. At works where tinplates are produced the toil is of a very strenuous character. To learn the making of articles of tinware it is usual for a boy to serve an apprenticeship for three or four years.

Tobacconists.—The bulk of the tobacco trade is in the hands of large and influential companies, but it must be remembered that these concerns employ a very considerable number of hands, and, so far as their shops go, the workers in most cases start as shop-boys or junior salesmen and work their way up to become assistants.

There is a great deal to be learned in the tobacco trade. The mere selling of cigarettes and packet tobaccos does not perhaps call for any great experience, but highly technical knowledge is required successfully to blend tobacco, to keep the fragrant weed in condition and to buy and mature cigars.

So far as the large tobacco factories are concerned, and they are to be found in such centres as London, Bristol, Belfast, Glasgow, Nottingham and so on, there is work for a veritable army of employees.

Tramway Workers.—The tramway services of the country afford work for an enormous number of people. To become a tramway driver it is necessary that a man shall pass through a course of training, which is invariably provided at one of the schools at a car depot. Here the candidate has explained to him the exact mechanism and system of propelling the car, and he is then instructed fully in the art of driving with safety. In most places a licence to drive is required. Very much the same plan has to be followed to become a conductor. Regulators and road inspectors are promoted from drivers and conductors. To become a servant to a tramways system the candidate should make personal application, and the morning is the best time to call. Only men of good character are taken on, and in some instances there is a medical and eyesight test to be passed before appointment is secured. In the higher branches of the service there are also openings. Tramway engineers are much sought after by municipalities. Then there are electrical and power-house engineers, traffic managers, a clerical staff, and so on.

Translators.—Quite apart from the purely literary side, there is a certain demand for the services of clever and accurate translators in most busy commercial districts. A business man may receive a letter from abroad in a foreign tongue, and not only require that it be translated, but also that a reply be written in the same language. When such a business is founded in a commercial neighbourhood it is usual to couple with it translation, shorthand and typewriting and other similar adjuncts. Upon the window of the office taken there should be a bold sign typifying the nature of the business; and, by the greatest accuracy and smartness, a good connection should in time be built up.

Tutors.—The position of tutor to the young sons of a wealthy family is naturally one much sought after, but it is only to be obtained by those who have received all the benefits of a full university education and who have plenty of influence. At most seats of learning, however, there are tutors who coach young men for a particular examination, and the Army tutor or coach is very well known.

Typefounders.—Not only in London, but in many provincial cities, there are firms of typefounders, their work being to make type of every class for the use of printers. In the higher branches of the work a very acute knowledge of founts of type and styles of lettering is required.

On the managerial side there are skilled workers well versed in the subject of metallurgy to whom is entrusted the task of buying raw material; among the ranks of the workers there are many highly skilled artisans.

Typewriting Experts.—In busy commercial centres a good connection can often be formed for the execution of typewriting of all classes, for sending typists with machines and paper to offices by the day, for the supply, hire, and repair of machines, and for the sale of typewriting sundries. Business may also be done in duplicating work and the manifolding of letters, circulars and so on. The person conducting such a business should be trained in commercial routine.

So far as authors' and playwrights' manuscripts are concerned, they are not usually placed with the purely commercial typewriting bureaux, but go to typists who have made a speciality of this class of work. About 1s. 6d. per thousand words of typing is usually charged, with half as much additional for carbon copies, and those who can undertake such work accurately and quickly, usually build up a connection for themselves by advertising in literary and theatrical journals.

Umbrella Manufacturers.—This business may be said to be in the hands of

a comparatively few large firms. There are women workers as well as men; and boys and girls may begin in the factories as learners. Apprenticeship is not general.

Upholsterer.—This is an important branch of the furniture trade, and in most districts a system of apprenticeship prevails, though small wages are paid to the apprentice during his time. The journeyman upholsterer is usually paid by the hour, but in some instances by the piece; there are openings in this trade for women as well as men.

Warehousemen.—A master warehouseman is a person owning a warehouse for the storage of goods. Near the docks and waterways, for instance, there are warehouses where non-dutiable goods are stored between the time they leave the ship and are required for actual use, charges being usually made according to the amount of space occupied.

A bonded warehouse is quite a different matter. Here dutiable goods are stored in bond from the time they are taken from the ship until needed; and all the while they are under the eyes of the customs authorities, for the duty is not payable until the goods are actually put to use. To become the proprietor of a bonded warehouse it is necessary to provide and equip a warehouse as regards doorways, locks and bolts to the full satisfaction of the authorities; and the owner must also give a personal bond for at least £1,000 and find reliable sureties for further amounts.

The term warehouseman may, however, be interpreted in quite a different way. For instance, in the drapery and soft-goods trade the person who takes charge of the stock that has not been passed into the shop is termed a warehouseman and occupies a highly responsible and well-paid position. Apprentices in the business may in time attain to the position, which necessitates a wide knowledge of the trade and also of efficient stock keeping.

Watchmakers.—Coventry still holds its own for the manufacture of the best class of British watches, but the trade is fairly well represented in the metropolis. A system of apprenticeship is almost universal, generally lasting for seven years. Even with the best watches, the bulk of the work necessary for their manufacture is mechanical.

Men who have served their apprenticeship at a factory may certainly set up as retail tradesmen; but, on the other hand, it is not necessary for a boy beginner to go to a factory. He may, for instance, serve his indentures with a working jeweller and watchmaker, learning first of all the most rudimentary work.

Wharfingers.—A wharfinger is a person owning a wharf alongside a river, canal or other waterway which provides the necessary appliances for the loading or discharge of cargoes from ships or barges. His charges may be merely so much per day for the accommodation afforded, but more frequently he will act as stevedore and warehouseman as well.

It naturally requires considerable capital to become a master wharfinger; but at this work many clerks and also labourers are employed, and a clerk who will make himself acquainted with shipping matters may find his post a good jumping-off ground to something offering greater prospects.

Wine and Spirit Merchants.—Few businesses are more hedged round with restrictions than this one, and there is a law for almost every type of liquor to be stocked. The actual licence duty to be paid by the shopkeeper is dependent upon his rent, his times of opening and such matters, of which full particulars may be obtained at the local Excise Office.

So far as the trade itself is concerned, it requires many years of training and experience to acquire all the knowledge necessary. There is a technical side, to do with the proof point in spirits, the selection and laying-down of wines, the storing of the stock under suitable conditions, bottling and similar matters. Wines alone form a lifetime's study.

To start in this business by far the best plan is to enter an establishment of good standing as a learner assistant.

Wool Workers.—One must go to the West Riding of Yorkshire to find the centre of the woollen industry—to Bradford, Leeds, Huddersfield, Dewsbury and similar places; and here it may be said that wool direct from the sheep's back is prepared for the tailor's needle.

One branch of the business has to do with the pure wool in bales direct from the shearing sheds—Southdown, Scots, Welsh and other wool from home; Egyptian wool; Australian wool, and other sorts. A boy worker entering this branch will in time pass through the stages in the sorting and preparation of the different wools for various purposes until he knows each variety by touch and smell.

Another branch has to do with the making of yarn, which in turn is woven into cloth, giving employment to countless women weavers at the looms. **A. C. M.**

BOOK-KEEPING.—XXXIX

Below are given the answers to the questions in the Test Paper which appeared on pages 245, 246.

Question 1.

DEPARTMENTAL TRADING ACCOUNTS FOR THE YEAR ENDING DECEMBER 31, 19...

Dr.

19..		A. Dept. £	s.	d.	B. Dept. £	s.	d.	C. Dept. £	s.	d.	Total. £	s.	d.
Jan. 1	To Stock in hand	1,000	–	–	3,000	–	–				4,000	–	–
Dec. 31	,, Purchases	2,400	–	–	1,100	–	–	4,600	–	–	8,100	–	–
	,, Wages	850	–	–	500	–	–	200	–	–	1,550	–	–
	,, Gross Profit c/d ..	3,350	–	–	1,600	–	–	4,000	–	–	8,950	–	–
		£7,600	–	–	6,200	–	–	8,800	–	–	22,600	–	–

Cr.

19..		A. Dept. £	s.	d.	B. Dept. £	s.	d.	C. Dept. £	s.	d.	Total. £	s.	d.
	By Sales	6,150	–	–	4,900	–	–	7,900	–	–	18,950	–	–
Dec. 31	,, Stock, Dec 31. 1914	1,450	–	–	1,300	–	–	900	–	–	3,650	–	–
		£7,600	–	–	6,200	–	–	8,800	–	–	22,600	–	–

Dr. PROFIT AND LOSS ACCOUNT. *Cr.*

	£	s.	d.		£	s.	d.
To Salaries	750	–	–	By Gross Profit			
,, General Expenses	850	–	–	A. Dept.	3,350	–	–
,, Rates and Lighting	250	–	–	B. Dept.	1,600	–	–
,, Bad Debts	200	–	–	C. Dept.	4,000	–	–
,, Depreciation, 10 per cent. on Plant, etc.	250	–	–	,, Discount (balance)	300	–	–
,, Mortgage Interest	40	–	–				
,, Net Profit	6,910	–	–				
	£9,250	–	–		£9,250	–	–

BALANCE SHEET OF PHILIP SIMS AS AT 31st DECEMBER, 19...

LIABILITIES.	£	s.	d.	ASSETS.	£	s.	d.
Bank Overdraft ..	300	–	–	Cash in hand	50	–	–
Sundry Creditors ..	2,900	–	–	Philip Sims' Loan A/c	1,500	–	–
Mortgage	2,000	–	–	Sundry Debtors ..	3,200	–	–
Mortgage Interest due	40	–	–	Stock :—			
Bad Debts Reserve ..	500	–	–	A. Dept. 1,450			
Philip Sims' Capital Account £3,000				B. Dept. 1,300			
Add Net Profit 6,910				C. Dept. 900			
£9,910					3,650	–	–
Less Drawings 2,500				Plant and Machinery £2,500			
	7,410	–	–	*Less* Depreciatn 250			
					2,250	–	–
				Freehold Premises ..	2,500	–	–
	£13,150	–	–		£13,150	–	–

Question 2.—It would first be necessary to draw up a statement of affairs or of assets and liabilities as at the end of the last financial period before inaugurating the double-entry system.

The books for the expired portion of the current financial period to date would be analysed, total purchases, wages, payments, bills met, cash received from debtors, bills drawn on customers, bills paid by customers, total sales, trade expenses, rent, rates, discounts, etc., being extracted.

These matters would then be journalised, and impersonal accounts inaugurated.

The amounts would be posted to the appropriate Ledger Accounts, and a Profit and Loss Account and Balance Sheet could be drawn up.

Question **3.**

BALANCE SHEET OF ABRAMS & CO., AS AT DECEMBER 31, 19...

Liabilities.	£	s.	d.	Assets.	£	s.	d.
Sundry Creditors, etc.	16,000	–	–	Property and Sundry Assets	30,000	–	–
Capital Accounts, December 31, 19..							
Abrams .. £5,000							
Brown .. 3,000							
Collins .. 2,000							
	10,000	–	–				
Net Profit							
Abrams 5/10 £2,000							
Brown 3/10 1,200							
Collins 2/10 800							
	4,000	–	–				
	£30,000	–	–		£30,000	–	–

CAPITAL ACCOUNTS.

Dr. ABRAMS' CAPITAL. *Cr.*

		£	s.	d.			£	s.	d.
Dec. 31	To Drawings Account	1,000	–	–	Jan. 1	By Balance	5,000	–	–
„	„ Balance c/d	6,000	–	–	Dec 31	„ Profit (5/10) ..	2,000	–	–
		£7,000	–	–			£7,000	–	–
					Jan. 1	By Balance b/d ..	6,000	–	–

Dr. BROWN'S CAPITAL. *Cr.*

		£	s.	d.			£	s.	d.
Dec. 31	To Drawings Account	600	–	–	Jan. 1	By Balance	3,000	–	–
„	„ Balance c/d	3,600	–	–	Dec. 31	„ Profit (3/10) ..	1,200	–	–
		£4,200	–	–			£4,200	–	–
					Jan. 1	By Balance b/d ..	3,600	–	–

Dr. COLLINS' CAPITAL. *Cr.*

		£	s.	d.			£	s.	d.
Dec. 31	To Drawings Account	400	–	–	Jan. 1	By Balance	2,000	–	–
„	„ Balance c/d	2,400	–	–	Dec. 31	„ Profit (2/10) ..	800	–	–
		£2,800	–	–			£2,800	–	–
					Jan. 1	By Balance b/d ..	2,400	–	–

Question 4.—The chief difference between a " Receipts and Payments Account," and an " Income and Expenditure Account," is that the former shows all money actually received and paid out during the financial period under examination, and the latter shows income accruing during the financial period and expenditure charged against such income, irrespective of whether the income has been received or the expenditure met during the period.

The Receipts and Payments Account is the personal cash account of the treasurer of the undertaking concerned, and shows cash actually received and moneys paid out, whether relating to the financial period or not; the Income and Expenditure Account is in form the Profit and Loss Account of the undertaking.

Accounts of this nature are used by Clubs, Charities, Mutual Improvement Societies and similar bodies not carrying on a business. Expenditure will appear on the Dr. side, and Income on the Cr. side.

Question 5.

THE BISCOE MANUFACTURING

Dr. TRADING AND PROFIT AND LOSS ACCOUNTS

	£	s.	d.	£	s.	d.
To Stock at January 1, 19..				39,220	–	–
,, Purchases	71,437	–	–			
Less Returns	934	–	–			
				70,503	–	–
,, Manufacturing Charges				11,500	–	–
,, ,, Wages				31,952	–	–
,, Balance (Gross Profit) c/d				41,018	–	–
				£194,193	–	–
To Salaries				2,450	–	–
,, Trade Expenses				7,101	–	–
,, Rates and Taxes				492	–	–
,, Insurance	244	–	–			
Less Amount carried forward	90	–	–			
				154	–	–
,, General Expenses				3,021	–	–
,, Discount				1,900	–	–
,, Interest and Bank Charges				350	–	–
,, Depreciation.						
Land, etc., 3 per cent. on £22,250 ..	667	10	–			
Plant and Mach., 6 per cent. on £35,600 ..	2,136	–	–			
Loose Tools, 10 per cent. on £2,360 ..	236	–	–			
Patents, 10 per cent. on £5,000	500	–	–			
Fixtures and Fittings, 5 per cent. on £680	34	–	–			
				3,573	10	–
,, Bad Debts				972	–	–
,, Bad Debts Reserve, 5 per cent. on £57,640	2,882	–	–			
Less Old Reserve	2,600	–	–			
				282	–	–
,, Directors' Fees ..				723	5	–
,, Managing Director's Remuneration ..				1,826	–	–
,, Audit Fee Reserve				50	–	–
,, Balance (Net Profit) c/d				18,123	5	–
Total				£41,018	–	–

THE BISCOE MANUFACTURING

BALANCE SHEET AS

LIABILITIES.	£	s.	d.	£	s.	d.
NOMINAL CAPITAL.						
24,000 ordinary shares of £5 each	120,000	–	–			
ISSUED CAPITAL.						
18,000 ordinary shares of £5 each fully paid ..				90,000	–	–
Reserve Account	6,000	–	–			
Added this year	2,500	–	–			
				8,500	–	–
Bills Payable				4,380	–	–
Sundry Creditors				26,052	–	–
Directors' Fees				723	5	–
Managing Director's Remuneration				1,826	–	–
Audit Fee Reserve..				50	–	–
Profit and Loss Account.						
Balance, January 1, 1918	750	–	–			
Add Profit for year	18,123	5	–			
	18,873	5	–			
Less Transfer to Reserve	2,500	–	–			
				16,373	5	–
				£147,904	10	–

COMPANY, LIMITED.

FOR THE YEAR ENDING DECEMBER 31, 19..

Cr.

	£	s.	d.	£	s.	d.
By Sales	165,395	–	–			
Less Returns	1,222	–	–			
				164,173	–	–
„ Stock on December 31, 19..				30,020	–	–
				£194,193	–	–
By Trading A/c (Gross Profit) b/d				41,018	–	–
				£41,018	–	–

COMPANY, LIMITED.

AT DECEMBER 31, 19...

ASSETS.	£	s.	d.	£	s.	d.
Land and Buildings	22,250	–	–			
Less Depreciation	667	10	–			
				21,582	10	–
Plant and Machinery	35,600	–	–			
Less Depreciation	2,136	–	–			
				33,464	–	–
Loose Tools	2,360	–	–			
Less Depreciation	236	–	–			
				2,124	–	–
Patents	5,000	–	–			
Less Depreciation	500	–	–			
				4,500	–	–
Fixtures and Fittings	680	–	–			
Less Depreciation	34	–	–			
				646	–	–
Stock				30,020	–	–
Sundry Debtors	57,640	–	–			
Less Bad Debts Reserve	2,882	–	–			
				54,758	–	–
Unexpired Insurance				90	–	–
Cash in hand				168	–	–
„ in Bank				552	–	–
				£147,904	10	–

F. H.

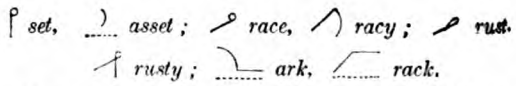
SHORTHAND.—XXIV

Key to Exercise 80

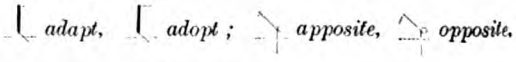
Key to Exercise 81

1. The Musical-Society formed some-months-ago by Captain-Jackson has attracted considerable-attention, and-several well-known musical-authorities have expressed their approval.
2. The Postal-Department and-the Shipping-Department have-been very busy for-some-months, and-we-are making-arrangements for an enlargement of-the-premises.
3. The most-important national-bank in-the-world is-the Bank-of-England, which-was founded in-the-year 1694. Its directors fix-the bank-rate.
4. We-think Professor-Morgan was treated in a liberal-manner in connection-with-the lectures delivered to-the Dramatic-Society, despite the statement in-the Literary-Journal.
5. Please give early-attention-to-the-matter, as-the Town-Council desire to-have-the necessary-forms by-the end of-the-present-month.
6. This-morning the Passenger-Superintendent sent a further-communication regarding-the extra-charge, about which we wrote fully three-months-ago. I-shall-be-glad if-you-will call here at your-early-convenience to-discuss-the-matter.

Distinguishing Outlines.—Throughout this course of lessons the student will have found that in the majority of cases the application of the ordinary rules of the system provides him with distinctive outlines—even when unvocalized—for words having the same or similar consonantal formation. For example, the rules for the use of the numerous circles, loops and hooks, etc., have all been so formulated as to indicate, in the great majority of cases the presence or the absence of vowels. Compare for example, the following pairs of outlines, and this fact will be plainly demonstrated.

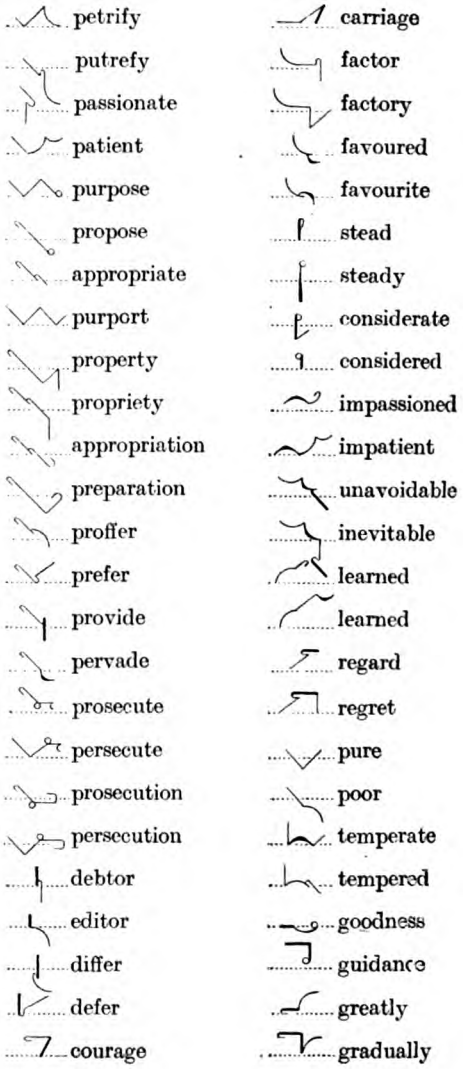


Where, however, the distinguishing vowel is not indicated by position or by the special form of the outline, the vowel-sign should be shown. Note the following outlines:—



It will therefore be seen that vocalization in Pitman's Shorthand is necessary in but a limited degree.

In the case of words of the same consonantal construction, where there might possibly be a danger of "clashing," the difficulty is overcome by the use of alternative forms. The following list will suggest the method by which pairs of words may be distinguished.



evidence
confidence
station
situation
patron
pattern
proper
prepare
protect
product
comparative
operative
portend
pretend
person
parson
parcel
parasol
breath
birth, berth
tenant
continent
trifle
trivial
travel

Representation of Figures.—The figures *one* to *seven* and the figure *nine* may be represented by shorthand outlines. In order to avoid any danger of mistranscription, other numbers, except round numbers, are better expressed by Arabic numerals. The following method is adopted for the representation of round numbers—*hundred* or *hundredth* by , and *thousand* or *thousandth* by (; thus 3 = 300 ; 3(= 3,000 ; 3 = 300,000 ; 3 = £300,000. *Million* or *millionth* by , and *billion* by ; thus 4 = 4,000,000 ; 5 = *five billion*. *Dollars* is represented by , thus 3 = $3,000.

Exercise 82

1.
2.
3.
4.

5.
6.
7.

Key to Exercise 82

1. The carriage attendant showed great courage, and it was agreed by the station staff that he had saved the situation.
2. We do not quite grasp the purport of the message, but we are inclined to doubt the propriety of the attitude adopted by this person. The parson and the editor regard with regret the conduct of the debtor.
3. The parcel, in which was the parasol of our patron, was greatly damaged on arrival at the station. Damage of this kind would seem to be inevitable on this line, although we do not find it unavoidable on others.
4. It is generally considered that the editor might have been more considerate to the debtor, whose liabilities are £3,000 and his assets £2,000. A prosecution in the present circumstances savours of persecution.
5. We think it natural that he should be anxious to protect his patent, which is the product of his own brain. It is no trivial thing in his mind, as he proposes to use the proceeds for experimental purposes.
6. He will prepare a proper form of agreement, which the factor can obtain when he visits the factory.
7. The price of the alterations will be £400, which I regard as very reasonable, considering the fact that the property is valued at £500,000. We regret that you consider it excessive, but in view of the almost inevitable increase that will soon take place we should like to point out for your guidance that it is possible the work will shortly cost about £500. Please have the goodness to reply early.

Continued from page 335.

ENGLISH LANGUAGE AND LITERATURE:

Contributors:—ENGLISH LANGUAGE (W. A Craigie, M.A., LL.D.; E. W. Edmunds, M.A.). ENGLISH LITERATURE (John Derry, J.P.). PHILOSOPHY (E. H. Tripp, Ph.D.). POLITICAL ECONOMY (J. W. Urwin). ETHICS (W. H. Koebel). PUBLIC SPEAKING (J. W. Urwin).

POLITICAL ECONOMY.—IX

THE last half century has been remarkable in many ways. The population has increased enormously. Civilisation has advanced with rapid strides due in a great measure to better educational facilities, and the production of wealth has grown more rapidly than at any other period in the history of the country.

Although wages and the purchasing power of wages both have risen very considerably during the same period—and although work is more constant and the hours of labour have been shortened, yet a feeling of unrest has been growing for some years, not only in England but on the Continent, demonstrating itself in proposals for reforms and revolutionary measures.

Industrial Unrest

It is comparative poverty in the midst of ostentatious wealth, the apparent increase of liberty, leisure and luxury and the increased pleasure which wealth affords as compared with the toil and labour, which has raised a grudge in the heart. This has given rise to the idea in the minds of the working classes that wealth is unjustly divided, and has raised a demand for the inauguration of a system of society wherein there will be greater equality.

These claims are advocated with all sincerity and with a desire to benefit the community, but they are of such a far-reaching nature that they should be examined with the closest attention. No chapters on Political Economy would be complete which fail to deal with these proposals however revolutionary or unconstitutional they may appear to be.

Individualism can be carried too far, and it is often the excess of a system which drives a portion of the community to excesses in an opposite direction, missing the central point where justice and equity lie.

Probably the accumulation of capitalism in the hands of a few private individuals has driven the workers to seek redress for some of their grievances, real or imaginary, in the advocacy of a system of society where all land and capital shall be owned and controlled by the State.

Such a system is advocated by Socialists, Anarchists, Syndicalists, and in a milder and less revolutionary manner by the Land Nationalists and those who favour the Nationalisation of the Railways and Mines.

We will first examine the proposals of the Socialists as they are undoubtedly the strongest body and have the largest following.

The short definition of Socialism is "the socialisation of the means of production, distribution and exchange."

Socialistic Doctrines

The Socialist always asserts that the State is the people, and builds up his claim on the basis of the doctrine of Karl Marx that "labour creates all wealth and to labour all wealth is due," that the lands and minerals are the property of the people and have been stolen from the people; that capital is the result of prior labour, and although it is now owned by the capitalist, it has been kept back from labour in the shape of profits.

It is worthy of note that Karl Marx, whose work *Das Kapital* is regarded as the Socialists' Bible, was an exile, a German Jew, and that his great work was written under circumstances which gave him a dark outlook on the conditions of society, and a nature which was soured by adversity, causing him to state that the rich are becoming richer and the poor poorer.

Socialism is no new doctrine; it is in its ultimate aims Communism and for many years was simply a theory; but now it has a large number of adherents, probably several million, in all the advanced countries of the world, and the doctrine is making rapid progress in the United Kingdom where it has representatives in Parliament, in Municipal Government, on the Boards of Guardians and other local bodies. The result has been a tendency to increase State action in many directions, and legislation has been passed within recent years which is said to favour the inauguration of Socialism.

The underlying principle which indicates Socialistic tendencies in State action is to be found in the answers to the simple question, whether the action fosters, stimulates and controls private enterprise, or whether on the contrary it absorbs, supersedes and destroys it.

The greatest opponents of Socialism do not deny the organised evolution of society and the consequent necessity for regulating the political, economic and industrial system, and the right, nay the duty, of the State to step in and make such rules and regulations as will be for the benefit of the community. They, however, deny the right of the State to step in and deprive one section of the community of their property for the supposed benefit of another section of the community.

The Economist's Standpoint

The Economist, however, examines the proposals from an entirely different standpoint from either the Socialist or the Capitalist. He approaches the subject from the purely economic point of view, and the question he tries to solve is: would the production of wealth be increased by the State owning the means of production and controlling the distribution on the lines laid down by the Socialist, namely, "equal remuneration for all workers"?

The Capitalist now controls production and directs labour; if the State owned the capital, directors of labour would still be necessary, and a share in production must be paid to them.

The watchwords of the Socialist are Liberty, Equality and Fraternity, and they contend that these very desirable qualities would be obtained under a system where private property interest in wealth and land would be a collective interest administered for the good of all.

When anyone speaks of Anarchy or the Anarchist we usually associate him with the Assassin and the Revolutionist of the very worst type. Some regard the Anarchist and the Socialist as the same, which is not fair to either. The two bodies have a common aim, that is, to deprive the holders of land and the owners of capital of their property. The Socialist says, hand it over to the State; while the Anarchist says he recognises no State, no authority: every man is a law unto himself.

Here we find the two extremes: the extreme individualist in the Anarchist, the Socialist as the advocate of State as the sole owning and controlling force. Yet both advocate the same principles up to the point where the rights in private property have been abolished, and then part company, and are as far apart as the poles.

The Anarchists are not a strong body, however, and it is not necessary to devote more than a passing word to their proposals.

Syndicalism

During recent years two new labour movements have sprung up under the names of Syndicalism and Industrial Unionism. The first named had its birth in France and the second in the United States of America; and although they are not identical they have much in common, and much common ground can be found between the Syndicalists and the Socialists, although some of the leading English Socialists denounce the proposals of Industrial Syndicalism, as the movement in this country is called, as madness.

Syndicalism proposes to merge Sectional Trade Unions, as they exist to-day, into a National Union to consolidate all organised workers in great national industrial departments such as Manufactures, Agriculture, Building, etc. Each of these great National Unions would organise, manage and itself work the whole of the production concerned for the benefit, not of the whole community, but for the benefit of its own members.

The aim of the Syndicalist is the distribution of the Capitalist and his profits. The methods to be adopted are (a) Sabotage—the production of inferior goods, wilful breakage of machinery, excessive general waste to render capital absolutely unremunerative. (b) The Passive strike and the Irritation strike. The workers are advised to remain at work but to reduce the output until an industry becomes unprofitable. (c) The Sympathetic strike. In these cases the workers, even though not involved in the actual dispute, deliberately withhold their labour in sympathy with other strikers.

(d) The General strike or the entire cessation of work over the whole kingdom.

The final result would be that each trade would then slip in, and own, and control its own industry.

It only appears to be necessary to draw the reader's attention to the way in which trades or even separate industries depend on other trades to recognise the difficulties if not the impossibility of carrying out these proposals.

It is admitted that the average Trade Unionist has been trained in an excellent school in routine work, but it does not produce the necessary qualifications demanded by the intricacies of industrial commerce of to-day. Routine men are essential, but progress in industry depends upon exceptional men, independent producers, organisers and manipulators in world markets. The worker is not trained for this class of work without which production would be reduced to a minimum and the workers would in the end be the sufferers.

Nationalisation

Although Nationalisation is not Socialism, it is regarded by economists as a step in that direction. Generally the advocates of Nationalisation suggest either purchasing the rights of private owners and paying the purchase price by giving Government Stock, or in some cases taking the property compulsorily after a term of years.

In either case the present owners would receive compensation. The controversy ranges itself under two heads :—

1. The question of what is adequate compensation.

2. Would Nationalisation benefit the community ?

So far as land is concerned, it is argued that there is no ownership of land as we have already seen, because it was originally granted by the Crown in return for services to be rendered, and the State can take possession of what it originally granted.

It must, however, be remembered that it was only land which was originally granted and that several centuries have passed since the original grant ; that land like other commodities has changed hands, and in addition to the original land, buildings have been erected and a large amount of capital has been invested. The land of Great Britain is now held by over two million proprietors.

On the other hand, it is contended that a purchaser of land or the man who invested his capital in buildings on land, did so with the full knowledge of the land tenure and took his risk ; that the advanced value of land is not due to any action on the part of the proprietor but such increased value has been created by the community to whom it rightly belongs.

It is contended that the railways, being the principal source of distribution of the necessaries of life, should be owned and controlled by the State ; that our railways in time of war are essential for transferring troops and provisions, and therefore are a necessary part of the defence of the country. The Act of 1844 (7 and 8 Vict., c. 85) provides for the purchase by the State of railways on the basis of 25 years' purchase at the average profits for the preceding three years, and it is contended that the State should exercise its powers under that Act.

In support of the claim for nationalisation of railways, the Continental System is quoted ; this is far too lengthy to be given in detail, but the reader will find the fullest information in the works of Emil Davies in favour of Nationalisation, and A. E. Pratt against Nationalisation.

The study of Economics will reveal faults in our present system and constitution, hardships and often injustice to certain classes of the community ; remedies present themselves and humanity claims their immediate adoption, but an examination will often reveal fallacies and imperfections of those remedies which would create greater injustice than those we propose to remedy.

The Nation's Good

We are dealing with human nature, which is complex, and it is the duty of the State to remedy evils, but at the same time to do justice to all.

When we have ascertained the root of the disease, look for a remedy ; but the remedy must be one which will bear the test of the closest examination, a remedy directed by an honest endeavour to benefit the nation as a whole, not a remedy which is dictated by feelings of sympathy for a particular class of the community and carried out at the expense of another class, but a remedy which preserves the liberty of the individual and measures out justice with equity.

Let us cast aside old traditions, ancient institutions, when, and only when, these can be replaced by a System of Society which can give us greater liberty, greater justice and make the nation prosperous.

We are indebted to the Economists from whose works we have quoted during this series of articles in attempting to elucidate the Principles of Political Economy. J. W. U.

PHILOSOPHY.—XV

By postulating time and space as purely subjective elements in sense-perception, Kant succeeded in throwing some light upon the peculiar nature of the truths of pure mathematics.

A distinguishing feature of such truths is their inevitableness; they seem apodictic and universal; we cannot imagine, for example, that 2 + 2 could ever make any other total than 4. On the other hand, the ordinary truths of experience, such as that solids expand when heated, do not possess this necessary character; we can easily imagine a body to contract when heated, as in fact a few do.

The superior certainty of mathematical truths is, according to Kant, due to the fact that they are essentially correlations of sense data in time and space, which are permanent mental elements (modes of perception) and necessarily accompany every mental act. But, as we shall see shortly, their peculiar character is also due to certain synthetic activities of the understanding.

Transcendental Logic

The function of the understanding is a synthetic one; it unites or combines the isolated, disperse data given to the sensibility, and thereby effects their conversion into knowledge. Now this synthetic activity comes into play whenever we make a judgment, that is, state a proposition, affirmative or negative. Thus in the judgment "The greatest thoughts come from the heart," the mind unites the two concepts "thoughts" and "heart" by means of the copula "come." Logicians have evolved a complete list of judgments, which they divide into four main classes, viz., quantity, quality, relation, and modality.

Each of these is in turn divisible into three sub-classes. Judgments of *quantity* express either unity, plurality, or totality; those of *quality* imply reality, negation, or limitation; judgments of *relation* include substance, causality, and reciprocity, and those of *modality*, possibility, existence, and necessity.

In exact correspondence with these twelve kinds of judgment, the understanding exercises twelve specific kinds of synthetic action. These are called the "categories" of the understanding. In themselves they are but empty forms, the materials given in the sensibility under the "pure" forms of time and space, alone bring them into activity, with the result that the isolated materials are correlated and knowledge ensues. The categories are 'pure" because without them knowledge is impossible; like time and space in another connection, they too represent the conditions of the possibility of experience (in the sense of knowledge).

Although Kant states most specifically that the categories are essentially of the nature of functional (synthetic) activities of the understanding, yet he also uses the term "pure concepts." Hence some commentators have drawn the inference that he regarded them as knowledge *a priori* in the sense that they are independent of sense-experience. It must not, however, be forgotten that the isolation of sensibility and understanding was only made for the purpose of investigation; in actuality they are inseparable, and each is essential to the other. "Perceptions without concepts (categories) are blind, concepts without perceptions are void."

Synthetic Judgments

The truths of mathematics, which we have referred to as being certain, possess a synthetic character. By a synthetic judgment is understood one in which the predicate adds something new to the subject, in contradistinction to an analytic judgment in which all the information conveyed by the predicate is already contained in the subject, and can be found by analysing it. Thus "money is something given in exchange for goods" is an analytical proposition because the notion of exchangeability (the predicate) is included in the notion "money" (the subject); but when we say "money is the miser's curse," the predicate "miser's curse" is not to be found by analysing the subject "money."

The boundary line between analytic and synthetic judgments is not always sharp; a synthetic judgment may be analytic to another person who has more knowledge,—thus in Kant's examples: "All bodies are extended" is analytic, and "some bodies are heavy" is synthetic, but to anybody perfectly familiar with the law of gravitation the possession of weight is as much contained in the concept "body" as is its property of occupying space, and to him the latter judgment is analytic. As an example of a mathematical synthetic judgment, Kant adduces, 7 + 5 = 12, and it is impossible to gainsay that the idea of twelve is given neither in seven, nor in five, nor in the connecting link, plus.

Whereas the judgments of formal logic

are all analytic in character, those of experience, those of science, are all synthetic; and therefore when Kant asks the questions: How are synthetic judgments *a priori* possible? How is pure natural science possible? he is only stating in other words his original problem: How is experience (knowledge) possible? According to Kant, the superior certainty of mathematical truths follows (*a*) from the *a priori*, subjective nature of time and space, and (*b*) from the circumstance that they are arrived at with the aid of certain "pure" categories of the understanding.

Causation

It will be noted that causality is given as a synthetic operation of the mind. When we affirm that A is the cause of B, we join up A and B in a synthetic judgment. Many philosophers who preceded Kant, including Descartes, Leibnitz, and Spinoza, held that a causal statement was analytic not synthetic, that the consequent B could always be deduced from the antecedent A. "There is nothing in an effect which is not to be found in its cause."

Thus from the idea of a triangle it is easy to deduce that its three angles are together equal to two right angles. In such cases, however, it is not a question of the causal relation, i.e., a connecting link, between successive phenomena, but rather of a co-existence of idealities. As Hume clearly pointed out, in actual experience we can never deduce B from A by logic, e.g., by no mental effort can we infer from the existence of sunlight that it kills certain bacteria.

To Hume, causation was merely a succession of events to which the mind supplied the connection, not by necessity, but by habit ("customary conjunction"). I fall into a pond and get wet. I call "falling into the pond" the cause, and "getting wet" the effect, because custom or habit has taught me that the one event invariably follows the other.

Kant occupies a middle position between these opposed opinions. He agrees with Hume that the causal nexus or relation is something not inherent in the phenomena themselves, but is supplied or "read into" them by the mind, but inasmuch as this mental contribution is one of the necessary conditions under which the materials given in sensation attain the status of knowledge, it is a necessary connection made by the mind.

As the categories do not represent the conditions under which objects are presented to the sensibility (for this can receive impressions which do not necessarily come under the synthetic functions of the understanding), the difficult question arose: How can the categories be made to apply to the objects? Answer: Through the *a priori* forms of time and space.

But then there is required a connecting link between the categories, the pure forms of the understanding, and time and space, the pure forms of the sensibility. This junction is effected by the "productive imagination," and it is only through this that knowledge is actually realised in our subjective consciousness (*Selbstbewusstsein*).

This is the highest and final synthesis—the "unity of apperception" in which all the elements in cognition, and the data given in the sensibility, and the productive imagination working through the categories are combined into the individual unity of the ego or self-consciousness. From the various modes of the combination between the categories and the forms of the productive imagination Kant deduced a series of principles which constitute the foundation of the sciences of mathematics and physics.

Knowledge and Belief

"Reason," he wrote in a famous passage, "must go to Nature, with her principles in one hand and with experiment in the other, not after the fashion of a school-boy who merely listens to all that is told him, but as a Judge in Court who compels the witnesses to answer his questions."

Since "the conditions of the possibility of experience are equally the conditions of the possibility of the *objects* of experience," it follows that we can never know things-in-themselves. Cognition is limited. The categories are limited to the elements of possible knowledge presented under the forms of time and space. A being who possessed intuitive understanding, i.e., one whose apprehension was not limited and who did not perceive under the forms of time and space, alone could obtain knowledge of noumena.

But if human knowledge is circumscribed in the ways described, there is nothing to prevent the categories exercising their synthetic activities on materials not given in sense. That function of the mind which soars above possible experience and perambulates in regions where the understanding cannot tread, is called the Pure Reason (*Reine Vernunft*).

The activities of the Pure Reason give rise to three "ideas" (as opposed to concepts): the Soul, as the substratum underlying mental phenomena; the World, as the total-

ity of all things ; and God, as the cause of all things.

The subject matter of these " ideas " is entirely unknowable, but we may believe them nevertheless. They are useful, as they help us to unify and systematise our experience, and they supply us with the principles of belief, viz., the freedom of the will, the immortality of the soul, and the existence of God. Such beliefs have no intellectual basis, but a moral one. My conduct in life is influenced beneficially if I act on the suppositions that my will is free, that my soul is everlasting, and that there is a God, before all, in all, and over all.

Theory of Relations

In the excellent introduction to philosophy to which readers have been already referred, Bertrand Russell urges that the assumption that space and time are purely subjective elements, does not account for the certainty of mathematical, and certain logical, truths, for there is no warrant for thinking that our mental nature is unchangeable : we may not be able to see how 2 + 2 make 5 to-day, but there is absolutely no certainty that we may not be able to comprehend it to-morrow. The same thinker also objects to the Kantian subjective principles of the understanding, and he appears to regard the categories as knowledge *a priori* in the sense of being independent of experience.

We have seen that the categories are to be regarded as functions of the understanding which reduce to order and combine the individual, separate elements of sense-perception. In these acts of synthesis, the existence of relations between definite elements given in sense-perception is affirmed or denied, but the affirmation or negation of the relationship is something " read into " those materials by the mind.

Russell will have none of this, and he puts forward a theory of relations which is based on Plato's theory of " ideas." The latter are not ideas in the ordinary sense of the word—notions or concepts—but are perhaps best interpreted by the expressions, "general terms" or " relations "—thus whiteness, roundness, baldness are ideas, and so also are in, around, after, before, and nearly all verbs.

Any words, in fact, which connote something general, as opposed to words which connote something particular like I, you, he, now, and all proper names, are " ideas " or " universals." The inability of philosophers to recognise that not only adjectives and substantives but also prepositions and verbs express universals has had a profound influence upon philosophy, for since tho former express qualities of single things and the latter express relations between things, it came to be believed that " every proposition was to be regarded as attributing a property to a single thing, rather than as expressing a relation between two or more things." Hence it was supposed that, ultimately, there can be no such entities as relations between things.

The essence of this theory of universals is that relations have a real existence. The kind of reality ascribed to them is not that of ordinary objects or of mental states, but " something different " ; hence it is preferable to say that they " subsist " rather than " exist," or that they have " being," rather than that they have " existence."

The certainty of mathematical truths is, according to this theory, due to the fact that they deal exclusively with the relations of universals and are known intuitively. Thus the arithmetical truth that 2 + 2 = 4 is a statement concerning universals ; any collection of two added to any other collection of two makes a collection of four.

Such a truth may, of course, be derived from experience by the inductive method, but certain general propositions are known to mathematicians in cases where single instances are entirely unknown.

Summary

The certainty of mathematical truths is partly accounted for by assuming the subjective, *a priori* nature of space and time.

The understanding acts by synthesising the isolated materials of sense-perception. There are twelve different acts of synthesis (the categories) corresponding to the twelve logical forms of propositions.

The categories are *a priori* in the sense that they condition the possibility of knowledge. Without sense-perceptions they are valueless.

Synthetic judgments express new knowledge, analytic judgments do not.

Many mathematical truths and statements expressing causality are synthetic judgments.

The synthetic faculty, called the " productive imagination," supplies the connecting link between sense-perception and the understanding.

The ultimate synthesis is that of all the cognitive elements into the unity of self-consciousness.

Knowledge is limited to the objects of possible sense-experience.

The Practical Reason deals with " ideas " (hypotheses) which can never be objects of knowledge, but which on practical grounds are worthy of belief. The theory of universals, i.e. of the extra-mental subsistence of relations, claims to account for the certainty of mathematical truths.

E. H. T.

ETHICS.—V

It is now time to discuss some of the conclusions towards which Ethics is intended to lead the student. One of the most important of these is the necessity for *struggle* in the life on earth.

The divine law is absolutely clear on this point. It applies, indeed, not only to mankind, but in some form or other to every living creature in the world. No animal exists that can sit down in peace and enjoy the even tenor of an unruffled existence. It is clear to all that if the birds gave up their ceaseless hunt for food, or relaxed their vigilance in guarding against the dangers from their natural foes, there would be an end of bird life.

Now the life of humanity affords an absolute parallel to this. But in the case of man it has been ordained that the character of the struggle should alter from the physical stage to the spiritual. The result of this is that men, as they progress in their spiritual development, find that it is not with their fellow-men that they must fight, but with the conditions of nature itself.

From the Physical Plane—

Ethics applies some laws in connection with this that at the first blush would appear stern, but that in actual practice are essentially reasonable. Mere material sympathy, it asserts, for instance, has very little moral value in itself. Thus, to adopt an orphaned child, and to raise it from poverty to a state of creature comfort is to leave the task but half done, and if the youngster be withdrawn from a more active field to the mere idle enjoyment of luxury, it is clear that, instead of good, actual moral harm has been done.

Goodness is not attained to without struggle, and it is by a strenuous and ceaseless use of the virtues that moral progress is achieved. The chief of these virtues, by the way, are generally admitted to be courage, temperance, justice, and wisdom. It is unnecessary to labour the fact that every one of these becomes a more efficient spiritual instrument through constant use. Not one of these virtues, on the other hand, is to be developed by means of any sudden bursts of enthusiasm. Their strength must increase gradually, and the process must be in perfect harmony with the moral nature of the man who cultivates them.

One of the most important lessons taught by Ethics, briefly put, is the importance of evolving the spiritual life from the material world. The beginning of man is purely materialistic, as we have already seen, but the seeds of the spiritual are within him from the day of his birth. The theory, then, is that by making proper use of these he may, while still on earth, employ his material and spiritual gifts in order to rise from the material to the spiritual plane.

The progress is slow at first, and gains in impetus only after it has passed a certain stage. Thus the beginnings of the work of morality are necessarily repressive and prohibitive, for at the start of life its task is to "restrain the wild animal impulses and destructive passions of man in order to prepare the way for spiritual activity."

There comes a time, in fact, when it is no longer necessary for morality to confine its force to mere negative action. It then begins to awaken a revolt in the soul of man against the material chain. It works towards glimpses of the spiritual world.

—to the Spiritual

It has been very truly said by Dr. G. A. Johnston, an authority whom we have already quoted, that: "All deeper religions and systems of philosophy have in common this requirement that man should give up his small self, and they promise that from this renunciation a new life shall be born, which is of infinitely greater meaning and value than the old life."

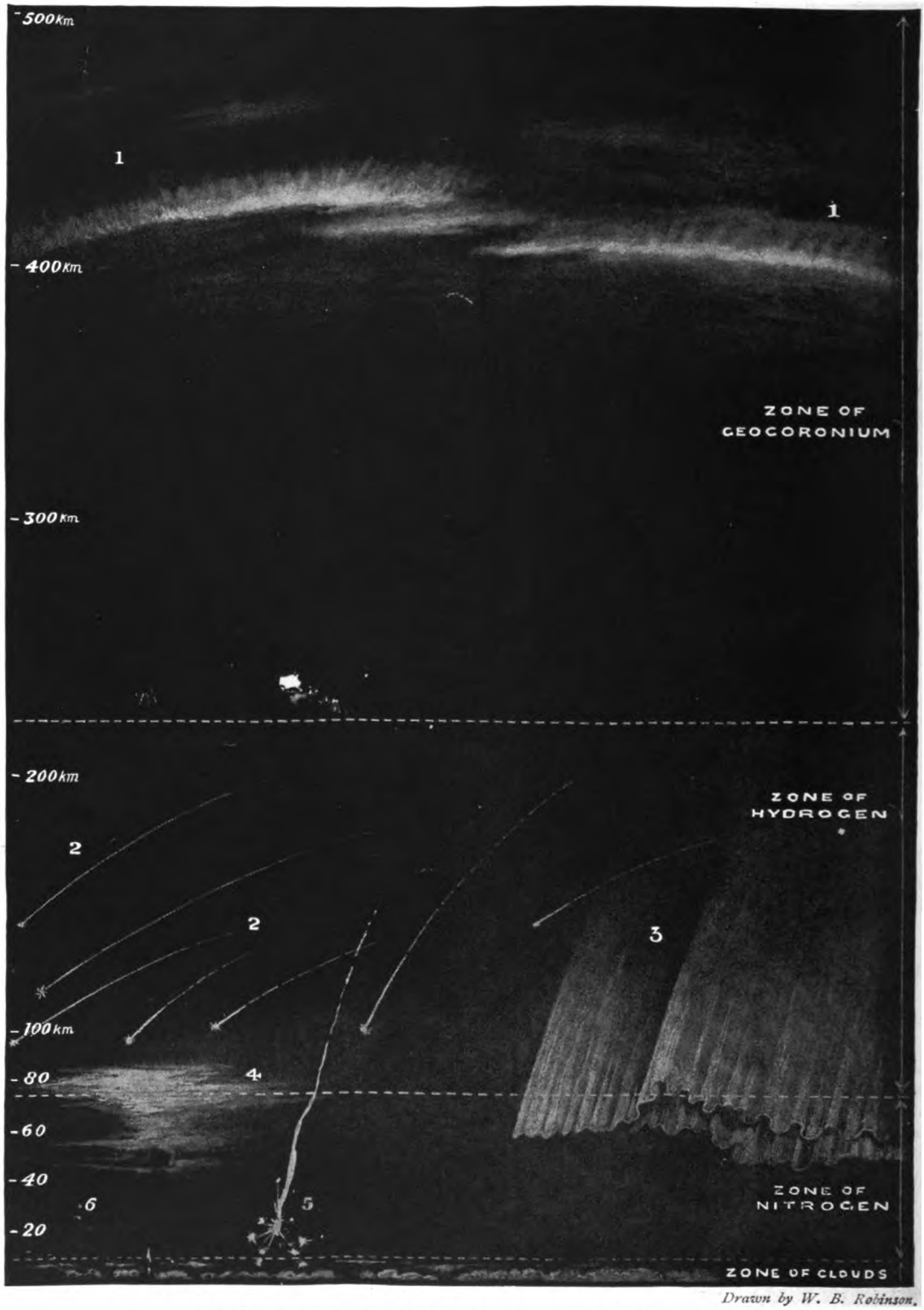
Something of the nature of this progress we have endeavoured to point out. There is one point, however, which remains to be strongly emphasised, although it has been indirectly touched on in connection with the contention concerning self-denial. This is that the good that is sought is the *common* good.

This axiom constitutes one of the pillars of the spiritual life. Its soundness, moreover, may be put to the test in the most practical way. The entire question has a similar bearing to the command: Do unto others as you would they should do unto you. Ethics, however, works out the necessity in the following way.

The first thought of every man should be for the common good. The man who takes this precept to heart has some assured methods of guidance at hand. He may be tempted to an action concerning the merits of which he is dubious. He has merely to ask himself the question: What would be the result to the world in general if everyone to whom the opportunity presented itself committed this action?

It is difficult to imagine a case with the answer in doubt.

W. H. K.



Drawn by W. B. Robinson.

CHEMICAL COMPOSITION OF THE UPPER AIR

has been determined by examining certain phenomena of sound, the spectra (1 and 3) of the Aurora Borealis, (2) shooting stars, (4) luminous clouds, (5) bolides, and by means of (6) sounding balloons. Near the ground, nitrogen and oxygen are found in the proportion of 78·1 per cent. to 20·9 per cent.; at 20 km. (12 miles) in the proportion of 85 per cent. to 15 per cent. At 100 km. the air consists of 55 per cent. of hydrogen, very little nitrogen, and of a gas which Prof. Wegener has called "Geocoronium."

Continued from page 406.

SCIENCES:

Contributors:—ANTHROPOLOGY AND ETHNOLOGY (Sir H. H. Johnston, G.C.M.G., K.C.B.). ASTRONOMY (Arthur R. Hinks, M.A., F.R.S.). BOTANY (E. W. Edmunds, M.A., B.Sc.[Lond.]). CHEMISTRY (E. H. Tripp, Ph.D.). ELECTRICITY AND MAGNETISM (L. M. Parsons, M.Sc.[Lond.], D.I.C.). GEOLOGY AND MINERALOGY (Arthur Holmes, D.Sc.[Lond.], A.R.C.S., D.I.C., F.G.S.). METEOROLOGY (L. M. Parsons, M.Sc.[Lond.], D.I.C.). PHYSIOLOGY (Sir Malcolm Morris, K.C.V.O., and D. W. Carmalt-Jones, M.A., M.D.[Oxon.]). SOUND, LIGHT, AND HEAT (E. W. Edmunds, M.A., B.Sc.[Lond.]). ZOOLOGY (E. A. Bryant and Ashley G. Brown, F.Z.S.).

METEOROLOGY.—VIII

THE development of Aviation has given great impetus to researches on the state of the atmosphere at different altitudes. A calm at the earth's surface may occur at the same time as a gale blowing at a height of perhaps 5,000 feet, hence the importance of these upper air researches. The earliest attempts at the investigation of the upper air were made long ago, before man ever imagined that he would fly through the atmosphere in machines heavier than air.

Researches in the Upper Air

A meteorological experiment with a kite was performed as far back as 1749. Balloons were first used in this connection during the dawn of the nineteenth century, but the more serious work has been done since 1882.

Three distinct modes of investigation of the upper air have been employed: experiments with kites, observations with balloons carrying passengers, and experiments with balloons carrying instruments but not passengers. The balloons which carry instruments only are known as *sounding balloons* since they endeavour to probe the higher portions of the atmosphere in much the same way as the marine sounding line probes the depths of the ocean.

By these means, many thousands of experimental ascents have been made and much valuable data obtained. Many notable passenger ascents have been made, including that of the celebrated meteorologist Glaisher, who reached an altitude of well over six miles. At such altitudes as that reached by the highest passenger balloon ascents, the temperature is below the freezing point, but much more important from a physiological point of view is the very much diminished pressure of the rarefied air. On account of these limitations and the consequent danger to human life, passenger ascents have been superseded by work with kites and sounding balloons, particularly the latter.

Very good work has been done with large box kites carrying self-registering instruments, but on account of the necessary line, made of wire, connecting the kite with the earth, there are serious limitations to this class of experiment. The greatest altitude reached by a kite is barely five miles, considerably less than that reached by passenger balloons. Also the wire of the kite acts as a lightning conductor, a fact which may necessitate the pulling in of the kite, since the instruments attached to it might be damaged or influenced by electrical conditions of the atmosphere.

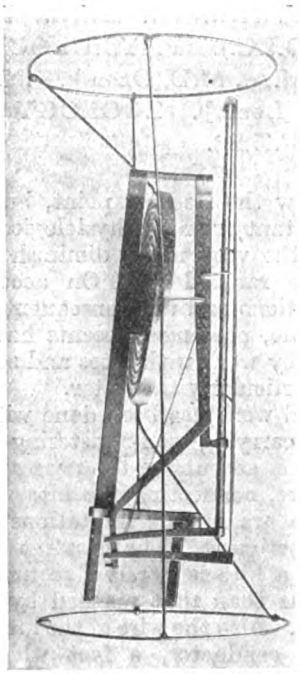
Sounding Balloons

The pilot balloon still does a large amount of useful work, particularly observations on those strata of air used by airmen who do not climb to great altitudes. By this means forecasts of the upper air are obtained. But in the modern endeavour to probe still further into the higher zone of the atmosphere, the *Ballon sonde* has become the leading factor. These sounding balloons are composed of silk or rubber, and ascend until they reach an altitude where the pressure is so far reduced that they burst. Self-registering instruments called *Meteorographs* are securely fastened inside a very light open cage-work attached by a long line to the

balloon. When the latter bursts, the meteorograph and its protective framework fall to earth.

Meteorographs

A meteorograph is a combination of several instruments, a veritable "multum in parvo." The whole combined apparatus usually weighs under two pounds yet contains a small aneroid barograph for tracing a record of air pressures, a thermograph for recording temperatures, and a hygrograph for registering the humidity of the air. For



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A METEOROGRAPH

is a very lightly constructed combination of several instruments; it includes an aneroid barograph, a thermograph, and a hygrograph.

the hygrograph, a bundle of human hairs is used, and as has already been explained (p. 149), the hairs alter in length as the humidity varies. Each of the instruments carries a lever with an attached pen so that pressure, temperature, and humidity graphs are traced on a sheet of paper. In some forms of meteorograph the paper consists of a flat circular sheet, while in others it is mounted on a cylindrical drum. In either case the paper is rotated by clockwork. The chief object is to reduce weight of the meteorograph as much as possible, not merely on account of the lifting power of the balloon, but because of the inevitable "crash" when the instrument reaches the earth.

Some modern instruments used with sounding balloons have steel points which record pressures, temperatures, and humidity as scratches on prepared metal instead of paper. The piece of metal bearing the graphs is quite small, about a square inch, so that a microscope is employed in reading the records. The whole instrument weighs about one ounce. A very light bamboo framework known as a "spider" is used for carrying the meteorograph which must be fastened very firmly to the frame to prevent the records being spoiled by jerks or oscillations.

Since the balloon presently ascends into realms of unclouded sunshine the instrument is protected from the sun's rays by an aluminium cylinder which surrounds it, but allows free play of the air around the instruments. The balloon itself will become warmed by sunshine, and in order that this shall not influence the instruments, particularly the thermograph, a strong thread at least 40 yards in length connects the balloon to the meteorograph. The framework bears a notice giving directions and offering a reward payable by the Meteorological Office for its safe delivery.

We have now to consider the chief results obtained from recent investigations employing kites, balloon—sondes, and meteorographs.

Troposphere and Stratosphere

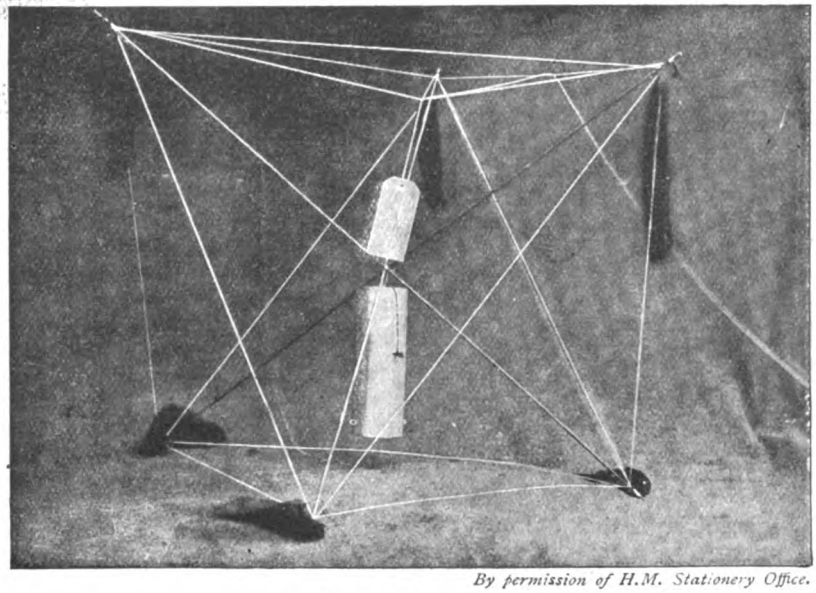
Meteorologists broadly consider the atmosphere to consist of two portions—a lower zone, called the *Troposphere*, extending from the earth's surface to a height of about 10 kilometres (about 6½ miles), and above this a much deeper zone called the *Stratosphere*. There is, of course, no sharp line of demarcation between these two zones.

The properties of the Stratosphere are much more uniform and far less complex than those of the lower Troposphere. Thus, in the Stratosphere, at altitudes between 6½ and 20 miles no clouds are formed and there is a fairly uniform temperature of about 72° on the Fahrenheit scale. We might speak of this as 104 degrees of frost, but it must be borne in mind that no condensation occurs in the Stratosphere, and although the *air* at that height is so cold, a balloon is heated by the brilliant sunshine. Evidently the Stratosphere is an *isothermal* layer of great thickness.

What conditions exist beyond the height of 24 miles? The answer to this question rests with the future development of meteorological methods.

With regard to the lower Troposphere, pressures and temperatures vary with altitude. As stated in this Vol. p. 204, there is evidently a fairly uniform decrease of pressure equal to ·1 inch of mercury for every 90 feet of ascent. This figure, therefore, represents a *vertical* barometric gradient. In obtaining this result, accurate corrections for temperature have been applied to pressure readings shown on meteorographs. The temperatures in the Troposphere also decrease upwards in a uniform manner until a height of about 10 kilometres is attained. The average rate of fall in temperature is about 10° F. per kilometre, or expressed in English units, 1° F. per 320 feet roughly. At altitudes exceeding two miles from the Earth's surface the temperature is not above the freezing point of water.

Temperatures may be expressed in readings of the *absolute* scale, and these may be converted from Centigrade readings by adding 273, as explained in a lesson on Heat (Vol. I., p. 278). Condensation, the formation of clouds, and the production of what is termed weather are brought about by processes taking place in the upper portion of the Troposphere. The velocity of winds near the ground is often only half of the velocity at greater altitudes on account of friction between the earth's surface and moving air, hence the wind velocity at different levels in the Troposphere is a problem of great importance in aviation.



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"SPIDER" FRAMEWORK,

made of very light bamboo; it is used for carrying the meteorograph in a sounding balloon.

Other Meteorological Work.

A good deal of work done at observatories and meteorological stations consists of taking observations of phenomena that are either meteorological "accessories," or very remotely connected with the study of the weather. Terrestrial Magnetism which is studied particularly at Kew, Valencia, and Eskdale is an almost independent subject connected with atmospheric phenomena by the slender link of northern lights or auroræ.

An even more feebly connected subject is Seismology, the study of Earthquakes, connected by the occurrence of atmospheric waves formed during an earthquake. Seismic observations are made at Kew and Eskdale.

Among the subjects that are more definitely related to Meteorology are *Earth Temperatures* and *Phenological Observations*. The temperature of the ground near the surface largely determines that of the air touching it; moreover, data concerning the temperature of the soil is of use to farmers and gardeners; consequently most meteorological stations take systematic readings of these temperatures and enter results on the temperature form described in Vol. V., p. 398.

Temperatures taken just above the surface of the ground indicate the loss of heat due to radiation from the earth at night if a properly constructed minimum thermometer is used for the purpose. Such an instrument, known as a *Terrestrial Radiation Thermometer*, consists of a spirit minimum thermometer placed in a hermetically sealed glass case. It is laid on short grass and covered with wire netting. The instrument is frequently referred to as the *Grass Minimum*, and readings should be entered in the corresponding column on the monthly report

form. The actual temperature of the ground itself is taken at two levels, one foot and four feet below the surface. A special slow-action thermometer is used in which the bulb is surrounded by wax, thereby preventing the mercury from changing its position

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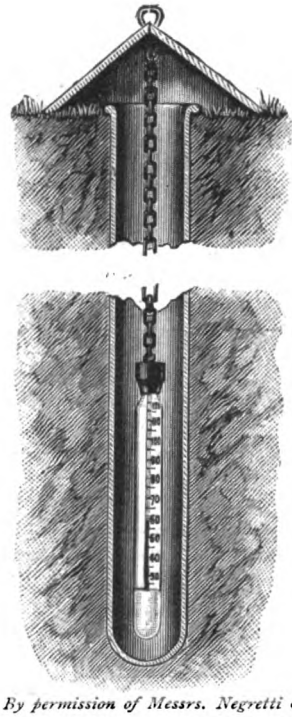
TERRESTRIAL RADIATION THERMOMETER

or, as it is sometimes called, the "Grass Minimum."

while a reading is being taken. The thermometer is surrounded by an outer glass case and the bulb is arranged at the required level —either one foot or four feet below the surface of the ground. The temperature at a depth of one foot is generally less than



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EARTH THERMOMETER.

A special slow-action thermometer; the bulb is surrounded by wax to prevent the mercury from changing position while a reading is being taken.

60° F. and at four feet it is usually less than 55° F. Interesting data concerning the seasonal variation in temperature of the soil is obtained by this means.

Phenological observations are made with a view to the collection of data on the influence of climatic conditions on animal and vegetable life. The first appearance of certain birds, insects, tree blossoms, etc., occur with definite climatic conditions, and the dates of such occurrences vary according to whether the season is unduly mild or otherwise. Observations on phenomena of this kind are of interest to those having a knowledge of Natural History, either Botany or Zoology, or both. Students having a liking for these subjects may give valuable aid in the collection of Phenological details, and the *Royal Meteorological Society*, 70, *Victoria Street, London, S.W.*, will forward advice and instructions to naturalists prepared to take up this branch of work. It should be emphasised that observations of this kind require considerable skill since observations must be accurate, and persons without some knowledge of Botany or Zoology can hardly render real assistance.

Meteorology is essentially a scientific not a legendary subject, and for genuine forecasts the student will do well to trust his instruments: the barometer, thermometer, and hygrometer. If he carefully notes the behaviour of these, and understands the significance of what he sees, he should obtain really useful guidance concerning the weather of the immediate future. L. M. P.

ZOOLOGY.—XXXVI

IT is a fairly safe statement that most people other than students of Natural History asked to classify a spider would place it amongst the insects. But as a matter of fact, scorpions, spiders, centipedes and some other creatures are not insects, but members of a class termed *Arachnida*.

And it is easy to see why this is so, since the insects, it will be remembered, are six-legged and have bodies formed of three distinct portions, while the *Arachnida* have four pairs of legs attached to the forepart of the body, and carry the head and thorax in an individual mass. Whether the thorax is divided from the abdomen depends upon the creature concerned; in many of the lower species no division is to be found, but in some of the higher such a division exists. There is another important point of difference in the fact that the *Arachnida* do not

undergo the change of form which takes place in the *insecta* during metamorphosis.

The earliest members of this class led an aquatic life, but these have long since died out, the king crabs alone surviving to represent them. All other existing members of the *Arachnida* are terrestrial, and breathe oxygen either through respiratory lamellæ sunk below the surface of the body or through tracheal tubes. The king crabs are marine but shore-frequenting creatures which live normally in water of moderate depth. They are found on the east coast of North and Central America, and in the East from the Bay of Bengal to China and Japan.

Scorpions

The scorpions, which are the largest and most formidable members of the *Arachnida*, are for the most part confined to the warmer regions of the earth. They are all more or less uniform in structure, the body being broad and long and ending in a long, jointed tail, and the four pairs of legs being furnished with movable claws. The head and shoulders are protected by a form of carapace not altogether dissimilar from that of the lobster. Occasionally, as in the case of the West African and Indian species, scorpions attain to a great size, some of them measuring nine inches in length. All are carnivorous and nocturnal in their habits.

During the day they may be discovered in hiding beneath rocks or fallen trees, and in some instances in self-made burrows. Scorpions are deservedly unpopular, by reason of their stinging propensities. The sting and poison glands are carried at the extremity of the tail which is usually curled upwards over the body when the scorpion is walking. Except in the case of the great African scorpion, its sting is more inconvenient than serious.

The best known of the European species are the *Buthus occitanus*, which is of somewhat formidable dimensions, and the black scorpions of the genus *Euscorpius*, which are abundant in some southern counties.

The spiders (*Araneae*) constitute a large group of the *Arachnida*, in which the body is divided into two parts, a narrow pedicel separating the joined head and thorax from the abdomen. With very few exceptions the latter is furnished with a number of glands, from which proceed the silky material used in the construction of the web. The eight legs each have seven joints, the eyes are "simple" and usually eight in number. All spiders are oviparous, and a considerable number of eggs are produced by the female at one time. These are concealed in a silky bag or cocoon, which the female sometimes carries about with her, and sometimes suspends in the web.

All spiders are predaceous, their prey consisting generally of small insects; certain large species of spiders, however, hunt large game. Mr. Bates, in "The Naturalist in the Amazons," speaking of the large spider of the genus *Mygale*, records that he was attracted to a tree trunk by the movement of a spider nearly two inches in length of body, and seven inches with legs expanded. The lower part of the web was broken " and two small birds, finches, were entangled in the pieces . . . one of them was quite dead, and the other lay under the body of the spider not quite dead, and was smeared with the filthy liquor or saliva exuded by the monster."

Fortunately the species in question, probably the *Avicularia avicularia*, is found only in tropical countries, though a few species belonging to the same family, but of small size, are found in Southern Europe, and one species in Britain.

Trap-door Spiders

The trap-door spiders construct nests of great interest. These nests resemble a tunnel driven downwards into the earth, the top of which is closed by a trap door, usually coloured so as precisely to resemble the surrounding earth. When the spider is at home with his trap door closed, it is as difficult for his enemies to find his home as it is for them to get into it. However, to make assurance doubly sure some species construct rooms opening off from the main tunnel and closed by additional trap doors. The trap door is composed of earthy particles firmly held together with layers of silk.

The family *Salticidæ* are wanderers who declined to be tied down to any web. It is their habit to prowl about in search of suitable prey, which they secure by suddenly springing upon it from some ambush. The members of this group are active-looking creatures of small size and, in the case of some tropical species, sometimes of vivid colours. The best known British species is the *epiblemum scenicum*, the members of which live in the crevices of walls, etc.

The family *Lycosidæ*, on account of their predatory habits, are known as the wolf spiders. Like the *Salticidæ*, they do not construct webs, though some species burrow in the ground. Others may be found under stones, in the crevices of rocks, under fallen leaves and in similar haunts. Some exhibit

a preference for marshy districts. The wolf spider may be seen making his way beneath the water down the stem of some aquatic plant, for he can continue submerged for so long as air remains confined among the hairs of his body. The most famous member of this family is the *lycosa tarantula* or "Tarantula," whose bite is much dreaded by the Italian peasantry.

The family *Thomisidæ*, or crab spiders, have broad and depressed bodies and the two first pairs of legs longer than their fellows. Their name is gained from a peculiar sidelong manner of walking. To a large extent these creatures depend for their food upon protective coloration. Many species live in flowers, the tints of which they accurately adopt. A well-known British species is the *misumena vatia*.

House and Garden Spiders

The house spiders of the family *Agelenidæ* are too well known to need description. In the same family we find several marine species, which occur on the coasts of South Africa, the Malay Peninsula, Burma and Australasia. These creatures have the strange habit of residing beneath rocks which are covered by water at high tide. This they do by constructing waterproof cells of silk. The European water-spider, *Argyroneta aquatica* found in freshwater pools in Britain, is also a member of this family.

But the species most generally associated in our minds with the word "spider" is undoubtedly the common garden spider of the family *Epeiridæ* or *Argiopidæ*. All the species in this group spin the well-known vertical circular web, and in one guise or another the family is represented all over the world. The shelter of the common spider, in which it resides and passes the winter, is a dome-shaped cell made of silky fibre. This cell is placed in the neighbourhood of the web, with which it is connected with a strong line.

Two dissimilar materials are used in the construction of the web itself, the foundation lines and centre lines being of stouter texture than the intermediate portions, in which a slender elastic thread covered with beads of a viscous substance is employed. The object of this difference, it is suggested, is to secure strength where strength is needed, and to provide an increased adhesive power to the section upon which a passing insect is likely to alight. The web is usually completed in about sixty minutes.

The spider, which awaits events in the centre, is made aware of the presence of its quarry by the movement of the web lines; in the same way it can tell in which portion of the web the insect is secured. Hurrying thither, it generally turns its victim round and round with the aid of its legs, and whilst doing so swathes it with silk from the spinnerets. There are some insects, however, such as wasps, which the spider does not welcome, and whilst it will occasionally secure them in conventional fashion, it not infrequently cuts them adrift as being in the long run the easiest method of dealing with them.

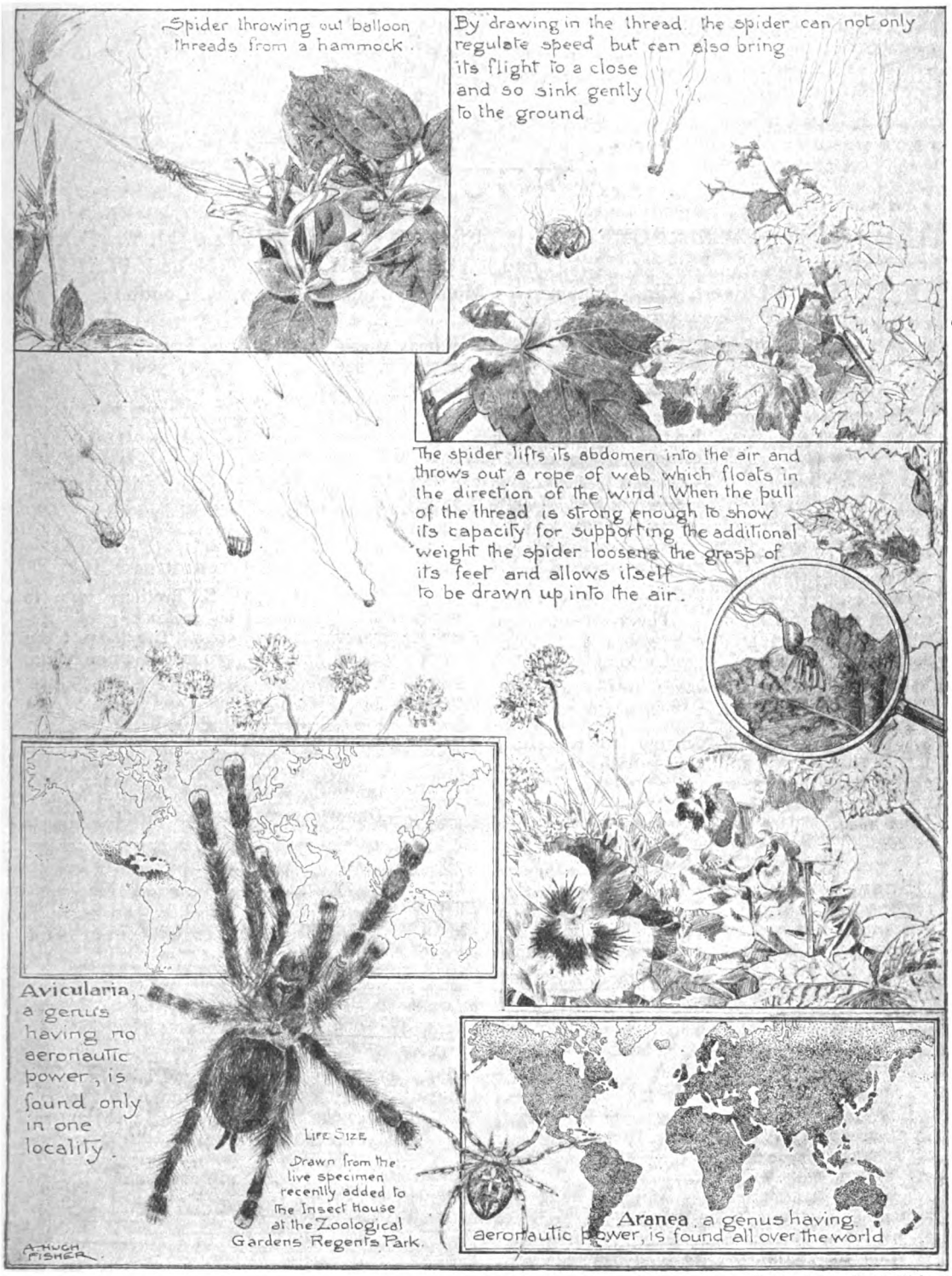
The difference in size between the male and female of the *Epeiridæ* is very noticeable, and is undoubtedly an unfortunate circumstance from the point of view of the male. Courtship for him is a hazardous and frequently a fatal undertaking. The female spider has no offer of sisterly affection with which to console the rejected suitor. The fate of such a one is death; she eats him; no plea can save him.

"False Spiders"

The *Opiliones*, or harvest-men, are found amongst a group known as "false spiders," in which the head, thorax and abdomen are entirely fused, giving the body a round appearance.

The order *Acari*, consisting of the mite or ticks, is allied to the foregoing family in body form. The majority of the members of this order are extremely small, some being of microscopic size; a few species, however, attain to half an inch in length. Many are parasitic on animals, and the order generally is responsible for great damage to plants and crops. The ticks are dangerous as agents by which diseases are transmitted.

Centipedes and millipedes, of the class *Myriapoda*, are found in all parts of the world, living amidst all conditions. The two groups concerned differ from each other in many respects, and may readily be distinguished by the arrangement of their legs, the centipedes carrying one pair upon each segment of the body, and the millipedes two pairs. The centipedes are carnivorous, and in some warmer regions attain almost a foot in length. Insects, small lizards, and even mice are devoured by them. These victims are secured by the fangs of the second pair of feet and are killed by poison. The largest known centipede is the *Scolopendra gigas*, of the West Indies and South America, an unpleasant creature some twelve inches in length. A. B.



Drawn by A. Hugh Fisher.

AERONAUTIC SPIDERS

and their curious methods of flight. Darwin, on his cruise in the *Beagle*, noticed ballooning spiders 60 miles from land. Such spiders are at the mercy of the wind; they have no power of guiding themselves.

Continued from page 418.

LANGUAGES:

Contributors:—LATIN, GREEK and FRENCH (E. A. Baker, M.A., D.Lit.). GERMAN (M. A. Lewenz, M.A.[Lond.]). SPANISH, RUSSIAN and ITALIAN (Alfred Calvert, First Prizeman in Modern Languages, R.S.A., London).

RUSSIAN.—XXXI

33—Answer to Letter No. 32

Мы чрезвычáйно огорчены́ содержáніемъ Вáшего уважáемаго письмá отъ . . . и прямо удивля́емся, какъ э́то всё могло́ случи́ться. Мы ужé съ Вáми рабóтаемъ не пéрвый годъ и, какъ въ былóе врéмя, мы тáкже въ дáнномъ слýчаѣ, наскóлько намъ извѣ́стно, сдѣлали всевозмóжное къ тому́, чтобы нашъ товáръ поступи́лъ на мѣ́сто назначéнія въ безукори́зненномъ состоя́ніи. Нашъ представи́тель посѣти́тъ Васъ на дняхъ и постарáется улáдить съ Вáми дѣ́ло.

We are much grieved by the contents of your esteemed letter of . . . and are simply surprised how all this could have happened. We are dealing with you not the first year, and as in the past, so in this case, we have, so far as we know, done everything to have our goods landed at destination in a faultless state. Our representative will visit you these days (shortly) and endeavour to settle the matter with you.

34—Another Complaint

Благодаря́ Вáшей замéдленной вы́сылкѣ, Вашъ товáръ получи́лся здѣсь пóслѣ сезóна. Въ виду́ сомни́тельности продáжи и неувѣ́ренности цѣнъ для меня́ нѣтъ разсчёта вы́ручить Вáшего товáра.

Owing to your slow delivery your goods have landed here after the season. As I doubt the sale of your goods, and am not sure of their prices, it does not pay me to take them in.

35—Answer to Letter No. 34

Изъ имѣющагося у Васъ коносамéнта соблагово́лите усмотрѣ́ть, что товáръ нáми былъ вы́сланъ въ услóвленное врéмя. За случáющееся въ пути́ и́ли мѣ́стѣ назначéнія мы никáкъ не мóжемъ принимáть отвѣ́тственности. Тѣ́мъ не менѣ́е, мы склонены́ уступи́ть Вамъ на семъ транспóртѣ дéсять процéнтовъ, каковáя ски́дка, надѣ́емся, вполнѣ́ удовлетвори́тъ Васъ.

From the Bill of Lading to hand you may gather that we have shipped the goods on the stipulated date. For what happens on the road or in the place of destination we can in no way undertake any responsibility. Nevertheless, we are inclined to allow you on this lot ten per cent. rebate, which, we expect, will fully satisfy you.

36—A Communication

Нóсится слухъ, что фи́рма . . . въ настоя́щее врéмя перетерпѣва́етъ большóе стѣсне́ніе въ деньга́хъ.

It is rumoured that the firm . . . is at present experiencing great financial difficulties.

37—Another Communication

Бра́тья З. какъ ви́дно, успѣва́ютъ. Они́ сня́ли ещё́ два больши́хъ скла́да и удвои́ли свой служéбный персона́лъ. Отзывъ ба́нка осóбенно удовлетвори́теленъ. На склáдѣ мнóго францу́зскаго и швейца́рскаго това́ра.

Z. Brothers seem to be making good progress. They have taken two more big warehouses and have doubled their staff. The bank's opinion is particularly satisfactory. There are many French and Swiss goods in the warehouse.

38—Drawing a Bill of Exchange

Въ уравне́ніе причита́ющихся мнѣ съ Васъ по моему́ счёту отъ . . . я сего́ числа́ вы́ставилъ на Васъ перевóдъ въ су́ммѣ . . . , котóрые соблагово́лите оправда́ть, чѣмъ премнóго обя́жете.

To square your arrears according to my invoice of . . . I have to-day drawn on you a bill of exchange for the sum of . . . which kindly honour, and oblige.

39—Answer to Letter No. 38

Согла́сно Вáшей прóсьбѣ, я оправда́лъ Вашъ перевóдъ на су́мму . . . Для бу́дущаго однáкожъ прошу́ Васъ не выставля́ть на меня́ перевóдовъ безъ спрóса.

In accordance with your request I have honoured your draft for the sum of . . . In the future, however, please refrain from drawing upon me without asking.

40—Another Answer to Letter No. 38

Такъ какъ по пóводу су́ммы . . . по Вáшему счёту отъ . . мéжду нáми возни́къ споръ о нѣ́которыхъ ра́зницахъ, котóрыя бы́ли изло́жены въ моёмъ письмѣ́ отъ . . ,

As a controversy has arisen between us on account of the sum of . . . in your invoice of . . . against which I have some claims, as detailed in my letter of . . . I

я нахожу Вашъ посту́покъ выставле́нія на меня́ перево́да самово́льнымъ и не имѣющимъ для меня́ никако́го значе́нія.

consider your act of drawing upon me arbitrary and of no import to myself.

41—Reminder About Arrears

Просма́тривая мои́ кни́ги, я нашёлъ су́мму . . . ещё откры́той на Ва́шемъ де́бетѣ, а потому́ поко́рнѣйше прошу́ Васъ присла́ть мнѣ э́ту су́мму нали́чными съ пе́рвой по́чтой.

On going through my books I have found the sum of . . . still open to your debit, and therefore ask you kindly to send me same in cash by return of post.

42—Answer to Letter No. 41

Спѣшу извини́ться за заме́дленное покры́тіе. Причи́на—недосмо́тръ со стороны́ бухга́льтера. При семъ прилага́ю де́нежный перево́дъ на су́мму . . . . получе́ніе кото́го благово́льте подтверди́ть.

I hasten to apologise for the belated settlement. The reason was an oversight by the book-keeper. Enclosed please find cheque for the sum of . . . the receipt of which kindly acknowledge.

43—Warning

Не смотря́ на мои́ неоднокра́тныя напомина́нія о Ва́шемъ долгѣ, Вы всё вре́мя ограни́чивались упо́рнымъ молча́ніемъ, а потому́ настоя́щимъ категори́чески заявля́ю Вамъ, что, е́сли отъ Васъ не послѣдуетъ удовлетвори́тельный отвѣтъ до исхо́да сего́ мѣсяца, дѣло бу́детъ пере́дано суду́.

Notwithstanding my reiterated admonitions about your debt, you have tenaciously kept silent all the time. Therefore I beg to announce to you categorically that if I do not receive from you any satisfactory reply by the end of the month I shall transfer the matter to legal channels.

44—Answer to Letter No. 43

Торго́вля всё вре́мя была́ плоха́, такъ что я е́ле своди́лъ концы́ съ концо́мъ. Прошу́ Васъ потерпѣть ещё оди́нъ мѣсяцъ, по́слѣ чего́ я Вамъ отошлю́ долгъ съ проце́нтами.

Trade has been bad all the time, so that I have hardly been able to make ends meet. Please keep patient for another month, after which I shall refund to you the debt with interest.

45—Request for Release of Goods

По получе́ніи сего́ благово́льте предписа́ть ба́нку о вы́дачѣ мнѣ накладно́й на Вашъ това́ръ свобо́дно. По осмотрѣніи мно́ю това́ра и нахожде́ніи его́ въ поря́дкѣ я пришлю́ Ва́мъ полови́ну нали́чными и полови́ну ве́кселемъ.

On receipt of this please instruct the Bank to hand me out the Bill of Lading free. After examining the goods and finding same in order, I shall remit to you the half in cash and half by bill.

46—Answer to Letter No. 45

Мы сего́дня телегра́фировали банку, чтобы дубликатъ накладно́й за №... Вамъ былъ вы́данъ свобо́дно.

We have wired to the Bank to-day to hand you out the Bill of Lading No. . . . free.

47—Request to Extend the Term of a Bill

Непредви́дѣнныя обстоя́тельства застав ля́ют меня́ обрати́ться къ Вамъ съ про́сьбой объ отсро́чкѣ моего́ ве́кселя, плате́жъ по коему́ наступа́етъ 15-го Февраля́ с./г. на два мѣсяца. Благово́льте распоряди́ться Ба́нку не допусти́ть моего ве́кселя къ проте́сту.

Unforeseen circumstances force me to ask you kindly to extend the terms of my bill, which is due on the 15th February a.c., for another two months. Please instruct the Bank not to allow my bill to be protested.

48—Answer to Letter No. 47

Вашъ ве́ксель, сро́чный 15-го Февраля́ с./г. былъ на́ми учтёнъ два мѣсяца тому́ наза́дъ. Не зна́я, въ чьихъ рука́хъ тако́й ве́ксель тепе́рь нахо́дится, мы не въ си́лахъ сдѣлать отсю́да каки́хъ ли́бо распоряже́ній въ удовлетворе́ніе Ва́шей про́сьбѣ. Мы наде́емся, одна́кожъ, что, не смотря́ на Ва́ши затрудне́нія, Вы всё таки́ найдёте исхо́дъ къ оправда́нію Ва́шего обяза́тельства.

Your bill due on the 15th February a.c. was discounted two months ago. Not knowing its present whereabouts, we have not the power to send out from here any instructions in compliance with your request. We are, however, confident that, notwithstanding your difficulties, you will still find a means of meeting your obligations.

49—Request About Deferred Payments

Вопреки́ всѣ́кимъ ожида́ніямъ, урожа́й въ настоя́щемъ году́ вы́палъ чрезвыча́йно плохи́мъ. Такъ какъ въ на́шемъ кра́ѣ всё зави́ситъ отъ урожа́я, я поэ́тому не могу́ разсчи́тывать ни на бо́йкую прода́жу, ни на регуля́рные платежи́ въ э́томъ году́. Хотя́ мнѣ причита́ются съ мои́хъ покупа́телей дово́льно кру́пныя су́ммы, и хотя́ они́ всѣ че́стные лю́ди, я всё таки́ не могу́ съ увѣренностью сказа́ть, что съумѣю легко́ оправда́ть при́нятыя на себя́ обяза́тельства.

По э́тому предлага́ю Вамъ перемѣни́ть всѣ мои́ векселя́ на но́вые,

Contrary to all expectations, the harvest has fallen (turned) out very bad this year. As in our district everything depends on the harvest, I cannot reckon on any brisk sale or regular payments (in) this year. Although my customers owe me large amounts, and they are all honest people, I cannot, in spite of all this, say with certainty that I shall be able to meet easily the obligations undertaken by me.

I therefore propose to you to exchange all my bills for new ones (renew

ка́ждый съ удлине́ніемъ въ шесть мѣсяцевъ отъ своего́ ста́раго сро́ка и съ причётомъ шести́ проце́нтовъ годовы́хъ за ра́зницу въ сро́кѣ.

Надѣюсь, что въ си́лу на́шихъ долголѣтнихъ дру́жескихъ сноше́ній не отка́жете мое́й про́сьбѣ.

all my bills), each with an extension of six months from the old date, and with a surcharge of six per cent. per annum for the difference of maturity.

I hope that in consideration of our long and friendly relations my request will not be refused.

50—Answer to Letter No. 49

И́дя на встрѣчу Ва́шей про́сьбѣ, мы симъ выража́емъ на́ше согла́сіе на приня́тіе Ва́шего предложе́нія.

To meet you, we express herewith our assent to the adoption of your proposal.

Some Specimen Letters

Число́.....

Господа́мъ
Бра́тьямъ Гарне́,
ул. Бонапа́ртъ, 119.
въ Пари́жѣ.

Милости́вые Государи́.

Покорне́йше благодари́мъ Васъ за Ва́ше письмо́ отъ 10 с.м., съ зака́зомъ на:

25 францу́зско-Англи́йскихъ и Англи́йско-францу́зскихъ Словаре́й по 7/6.
25 То́же въ миніатю́рѣ по 2/-.
25 Дне́вниковъ для пи́семъ въ сафья́новыхъ перепле́тахъ по 2/6.

Согла́сно про́сьбѣ, мы таковы́е перешлёмъ Вамъ въ почто́выхъ посы́лкахъ, ка́ждая вѣсомъ въ 11 фу́нтовъ, а, гдѣ необходи́мо, попо́лнимъ вѣсъ на́шими новѣ́йшими повѣстя́ми.

При семъ вруча́емъ Вамъ роспи́ску въ получе́ніи Ва́шего перево́да для уравне́нія Ва́шего сче́та до 31-го Ма́рта. Факту́ра по Ва́шему но́вому зака́зу, кото́рый сейча́съ выполня́емъ, послѣ́дуетъ надлежа́щимъ поря́дкомъ.

Съ соверше́ннымъ почте́ніемъ,
Ка́ссель и Компа́нія,
Ли́митедъ.
Экспо́ртный Отдѣ́лъ.

Date....

Messieurs
Garnet Frères,
Rue Bonaparte, 119,
Paris.

Dear Sirs,

We are obliged to you for your letter of the 10th inst. with order for:

25 French-English English-French Dictionaries at 7s. 6d.
25 Do. Miniature at 2/-.
25 Letts' Diaries, bound in morocco, at 2s. 6d.

We will despatch these to you by parcel post, as requested, in packets of 11 lb. weight, and if necessary will make up the weight with some of our most recent novels.

Enclosed we beg to hand you receipt for your cheque in settlement of your account to 31st March. Invoice for your order now being executed will follow in due course.

We are, dear Sirs,
Yours faithfully,
Cassell and Co., Limited,
Export Department.

Число́....

Книгоизда́тельству
г.г. Геóрга Деламе́йна
и Ко.,
ул. Сентъ-Де́нисъ,
въ Пари́жѣ.

Милости́вые Государи́.

Симъ про́симъ соблаговоли́ть обрати́ть внима́ніе на но́вое сочине́ніе, кото́рое мы издаёмъ подъ загла́віемъ: "НОВЫЙ НАРОДНЫЙ ВОСПИТАТЕЛЬ." Оно́ издаётся въ частя́хъ 50. Впосле́дствіи оно́ вы́йдетъ то́мнымъ изда́ніемъ.

Мы пи́шемъ къ Вамъ въ надѣ́ждѣ, что Вы, быть мо́жетъ, скло́нитесь предприня́ть францу́зское изда́ніе ска́заннаго сочине́нія, такъ какъ мы увѣрены, что подо́бная кни́га должна́ имѣ́ть успѣ́хъ въ Ва́шей странѣ́.

Мы имѣемъ удово́льствіе препровести Вамъ проспе́ктъ сего́ сочине́нія и два про́бныхъ экземпля́ра части́чнаго изда́нія, а, е́сли на́ше предложе́ніе бу́детъ интере́снымъ для Васъ, мы охо́тно гото́вы посла́ть Вамъ всѣ про́чія уже́ вы́шедшія ча́сти, а остальны́я по мѣ́рѣ ихъ появле́нія.

Мы пребыва́емъ,
Съ соверше́ннымъ
почте́ніемъ,
Ка́ссель и Компа́нія,
Ли́митедъ,
Иностра́нный Отдѣ́лъ.

Date....

Messieurs Georges Delamain and Cie.,
Editeurs,
Rue Saint-Denis,
Paris.

Dear Sirs,

We should like to bring to your notice a new work we are publishing under the title of "The New Popular Educator," which is being issued in about 50 parts, and will subsequently also be published in volume form.

We write to you in the hope that you may be inclined to undertake a French edition, as we feel sure that such a work would meet with success in your country.

We have pleasure in sending you a prospectus relating to this work, also two sample parts, and if our suggestion interests you, we shall be happy to send you the balance of the parts so far issued and others as soon as published.

Yours faithfully,
Cassell and Co., Ltd.
Foreign Department.

Число́....

Господи́ну
Д. Мерсье́,
Фотогра́фщику,
въ Була́ни на Мо́рѣ.

Мили́стивый Государь.

Симъ подтвержда́емъ получе́ніе Ва́шего почтѣ́ннаго письма́ отъ 27 числа про́шлаго мѣсяца съ прило́женнымъ собра́ніемъ фо́тографи́ческихъ сни́мковъ, представля́ющихъ ра́зные ви́ды Пари́жа, за что́ Васъ благодари́мъ.

Мы замѣча́емъ, что Ва́ша цѣна́ есть 10 фр. 50 санти́мовъ за воспи-

Date,...

Monsieur D. Mercier,
Photographer,
Boulogne-sur-Mer.

Dear Sir,

We beg to acknowledge the receipt of your letter of the 27th ult., enclosing a collection of photographs giving various views of Paris, for which we thank you.

We note that your terms are frcs. 10.50 for reproduction in one pub-

роизведéніе въ однóмъ тóлько издáніи, и что, éсли намъ потрéбуется сдѣлать дальнѣйшее употребленіе какóго нибýдь спеціáльнаго предмéта, Вы намъ егó достáвите по понижённой цѣнѣ, а йменно 7 фр. 50 сан.

Съ совершéннымъ почтéніемъ,
Кáссель и Компáнія, Лймитедъ.
Инострáнный Отдѣлъ.

lication only, and that should we require to make further use of any special subject you will supply it at a reduced price, namely, frcs. 7.50

We are, dear Sir,
Yours truly,
Cassell and Co., Ltd.,
Foreign Department.

A. C.

ITALIAN.—XIX

Comparison of Adjectives and Adverbs.—A few adjectives and adverbs form their comparative and superlative degrees irregularly, as :—

Adjective	*Comparative*	*Absolute Superlative*	*Relative Superlative*
alto, *high*	superiore, *higher*	summo, *very high*	il superiore, *the highest*
basso, *low*	inferiore, *lower*	ínfimo, *very low*	l'inferiore, *the lowest*
buono, *good*	migliore, *better*	óttimo, *very good*	il migliore, *best*
cattivo, *bad*	peggiore, *worse*	péssimo, *very bad*	il peggiore, *the worst*
grande, *large*	maggiore, *larger*	mássimo, *very large*	il maggiore, *the largest*
píccolo, *small*	minore, *smaller*	mínimo, *very small*	il minore, *the smallest*

Più or **il più**, etc., may also be used with all the above adjectives, especially when referring to actual size or the literal meaning.

Adverbs	*Comparative*	*Superlative*
bene, *well*	meglio, *better*	il meglio, *best*
male, *badly*	peggio, *worse*	il peggio, *worst*
molto, *much*	più, *more*	il più, *most*
poco, *little*	meno, *less*	il meno, *least*

The following adjectives and pronouns, when preceding a noun, are inflected as shown :—

	Singular			*Plural*		
	Before consonant	*Before vowel*	*Before z or s impura, or used independently*	*Before consonant*	*Before vowel, z or s impura*	*Used independently*
buono, *good*	buon	buon' (m., f.)	buono	buoni	buoni	buoni
bello, *beautiful*	bel	bell' (m., f.)	bello	bei	begli (begl' *before i*)	belli
grande, *great*	gran	grand' (m., f.)	grande	grandi *or* gran	grand' (*before vowel*) grandi (*before z or s impura*)	grandi
santo, *saint*	san	sant' (m., f.)	santo	santi	santi	santi
quello, *that*	quel	quell' (m., f.)	quello	quei	quegli	quelli

N.B.—**Questo**, **questa**, *this*, becomes **quest'** before any vowel.

Plural of Nouns and Adjectives.—The plural of feminine nouns and adjectives in **-ca**, **-ga** is **-che**, **-ghe**. Nouns and adjectives in **-co**, **-go**, masculine, usually make plural in **-chi**, **-ghi**, but those in **co** omit the hardening **h** in most cases, if the stress is not on the last syllable but one, as : **médico**, *physician*, **médici**; **luogo**, *place*, **luoghi**; **clienti tedeschi**, *German clients*.

There are some exceptions to the above rule, as : **amici**, *friends*; **nemici**, *enemies*; **porci**, *pigs*, etc.

Some masculine nouns in **-o** become feminine in the plural and end in **-a**, as : **l'ovo**, *egg*, **le ova**; **il muro**, *wall*, **le mura**, etc.

Augmentatives and Diminutives.—These terminations, which are here given only for the guidance of the student, are added to nouns, adjectives and adverbs to express diminution, increase, liking, depreciation, etc., as shown below, but their use is not recommended.

Augmentatives :—**-one** (**-ona**), **otto** (**otta**), **occio** (**occia**), denote increase of size and vigour, as : **gióvane**, *young man*, **giovanotto**, *strong young man*; **bene**, *well*, **benone**, *very well*.

-accio (**accia**), **astro** (**astra**), express contempt, as : **ragazzo**, *boy*, **ragazzaccio**, *nasty, dirty boy, urchin*.

Diminutives: **-ello** (**ella**), **etto** (**etta**), **ino** (**ina**), signify smallness, prettiness, compassion, tenderness, sweetness, youthfulness, as: **libro**, *book*, **librettino**, *nice, little book* (here two diminutives are added).

Rosso, *red*, **rossiccio**, or **rossastro**, *reddish;* **giallo**, *yellow*, **giallógnolo**, *yellowish;* **verde**, *green*, **verdiccio**, *greenish;* here we have the diminutives **-iccio**, **ógnolo**, **astro**, expressing the English suffix -ish or the word "rather."

Many feminine nouns become masculine and take the ending **-ino**, as: **la távola**, *table*, **il tavolino**, *nice little table;* **bene**, *well*, **benino**, *pretty well* (adverb).

The Adverb.—Adverbs are used to modify a verb, adjective or other adverb. In English they are usually formed by adding "ly" to an adjective, as: cold, coldly. This "ly" is expressed by **mente** in Italian, added to the feminine singular of the adjective, as: **caro**, *dear*, **caramente**, *dearly.*

The Preposition.—Prepositions show the relation of a noun or pronoun to some word in a sentence, as:

Parliamo di lúi,	*We speak of him.*
I fiammíferi si tróvano nella scátola,	*The matches are in the box.*
Colúi e coléi ai quali (a cúi) pensate sono partiti,	*That man and that woman* —i.e. *That one* (m., f.) *of whom you are thinking—have left.*
Costúi è lo zío, e costéi è la zia del vostro amico,	*That man* (near you) *is the uncle and that woman is the aunt of your friend.*
Un bicchiere di vino,	*A glass of wine.*
Un bicchiere da vino,	*A wine-glass.*

The Conjunction.—A conjunction connects words or sentences together, as:

Lo farò stamattina se avrò il tempo,	*I shall do it this morning if I have time.*
Glielo dirò, appena lo vedrò,	*I shall tell him as soon as I see him.*
Tosto che arriveranno le casse, ve ne darò avviso,	*As soon as the cases arrive, I shall give you advice thereof.*

The Interjection.—Interjections are words used to express sudden emotion, as:

Che peccato!	*What a pity!*
Oimè! oimè!	*Alas!*
Oh!	*Oh!*

O not used with **h** serves to attract attention.

Per bacco! *or* Per bacco baccone! Corpo di bacco!	*Dear me! By Jove! Good heavens!* (lit. Body of Bacchus).
Viva! evviva! Bravo (i, a, e)!	*Bravo, well done!*
Benone!	*Very well, first-rate.*
Al ladro!	*Stop thief!*

Miscellaneous Examples

La ricchezza di costoro (La costoro ricchezza) è enorme,	*Their riches are enormous.*
Coloro che ci hanno parlato, i quali sono venuti ieri, sono gli stessi uómini di cúi vi ho dato quell'avviso nella mía léttera del 20 scorso,	*Those* (men or women) *who have spoken to us, who came yesterday, are the same people about whom I gave you that advice* (information) *in my letter of 20th ultimo.*

Costoro and **coloro** are the plural (m., f.) of **costúi** and **colúi** respectively. **Costúi** refers to a person near the person addressed and **colúi** to someone farther away. **Cotesto, a** (adj.) means *that*, referring to something near the person spoken to, as:

Il nostro rappresentante in cotesta citta,	*Our agent in your city.*
Costì,	*In that place* (near you).

VOCABULARY

sentire, *to hear.*
ultimamente, *lately.*
il cameriere, *waiter.*
la patata, *potato.*
la carne, *flesh, meat.*
passeggiare, *to walk.*
accadere, *to happen, occur.*
la spesa, *expense.*
giúngere, *to arrive.*
aggiúngere, *to add.*
il pagamento a contanti, *cash payment.*
confidare, *to trust.*
affidare, *to entrust.*
accreditare, *to credit.*
dar fastidio, *to trouble, bother.*
la sorella, *sister.*
la contrattazione, *contract.*
la botte, *hogshead.*
la scarsezza, *scarcity.*
saldo, *steady.*
sérico, *silk* (adjective).
la sensería, *brokerage.*
calcolare, *to calculate, reckon.*
mantenere, *to maintain, keep.*
il cambiovalute, *money-changer.*
ripréndere, *to reply, rejoin.*
spéndere, *to spend.*
l'ésito (m.), *result.*
ricercare, *to seek for.*

Exercise 37

Translate into English:—

1. È la notizia più importante che ho (or: ío abbia) sentita ultimamente. 2. Dovrébbero restare a casa, se sono ammalati. 3. Dissi al cameriere: "Portátemi delle patate con un po' (= poco) di carne." 4. Passegiavo con qualche cliente. 5. Si trovávano con alcuni amici, quando ci vídero passare. 6. Párvero contenti di vederci. 7. Demmo loro della carta da scrívere e ce ne ringraziárono.

Exercise 38

Translate into Italian:—

1. They advised me that the contracts in these qualities amounted to over 2,000 hogsheads. 2. The great scarcity of greys (grey silks) contributed to make prices steadier on the silk market. 3. The accounts will be closed at the end of June and end of December. 4. They charged (brought into account) the brokerage caclulated at so much per cent. on the amount of the invoice. 5. He made me twenty promises and did not keep (tr.: maintain) one. 6. I took (conducted) him to the money-changer, whom you know. 7. "But he has not this money," I replied (rejoined), much astonished.

Key to Exercise 34

1. Andremo fra poco a Milano. 2. Il rialzo nel cambio ci darà l'occasione di fare migliori affari coll'éstero. 3. Devo (Debbo) pregarli di darmi una garanzía per la somma dell'órdine. 4. Quando vanno a Livorno? 5. Si fécero dare la pólizza di cárico la fattura. 6. Demmo loro molto fastidio, è vero, ma li pregammo di scusárcene. 7. Tosto ricevuti i colli, vi feci rimessa dell'importo relativo. 8. Il prezzo cadde (ribassò) tanto che non parve (non mi è parso) possíbile véndere le merci. 9. Diedi (Detti) una occhiata alle novità, ma non ne comprái niente. 10. Sono dolente (Mi duole) che le di lúi offerte non ábbiano per me speciale attrattiva.

Key to Exercise 35

1. They seized that opportunity to renew the draft. 2. I saw the man, but I did not give him anything. 3. He wished to learn Italian before leaving Florence. 4. He drank a glass of beer and went away. 5. They said it with bad intention, but did not harm me. 6. I placed my hand on his shoulder and explained the situation to him.

Key to Exercise 36

1. Volli imparare l'italiano prima di partire dall' Italia. 2. Bévvero alla salute di Súa Maestà e poi si díssero addío l'uno all' altro. 3. Vedrete i clienti giovedì próssimo e allora saprete che cosa fare. 4. Colse l'occasione per spiegare loro la situazione. 5. È vero che dissi tutto ciò, ma non vi nocqui in nessuna maniera. 6. Rimarremo nel magazzino fino alle sei.

Key to Exercise 37

1. It is the most important piece of news that I have heard lately. 2. They should stay at home if they are ill. 3. I said to the waiter: "Bring me some potatoes and a little meat." 4. I was walking with some customers. 5. They were with some friends when they saw us pass. 6. They appeared pleased to see us. 7. We gave them some writing paper and they thanked us for it.

Key to Exercise 38

1. Mi avvisárono che le contrattazioni in queste qualità ascésero a più di duemila botti. 2. La grande scarsezza di grezzi contribuì a réndere più saldi i prezzi sul mercato sérico. 3. I conti verranno chiusi a fine Giugno e a fine Dicembre. 4. Mísero in conto la sensería calcolata a un tanto per cento sull' ammontare della fattura. 5. Mi fecé venti promesse e non ne mantenne neppur una. 6. Lo condussi dal cambio-valute che voi conoscete. 7. "Ma questo danaro lúi non l'ha," ripresi io, ben sorpreso. A. C.

SPANISH.—XX

Key to Exercise 33

1. We used to see the buyer every day during the month of August. 2. This quality will not be worth the half of the price quoted. 3. He did his best, but he could not obtain it. 4. I gave him the bill so that he might accept it. 5. They never play when it is time to work. 6. Whether he falls or not, I am not going to trust him with any more money. 7. It was then that we often went to pay them a visit. 8. Unless you know him by sight, it is useless for you to go to meet him. 9. They put it on the table and went off. 10. He will becqme very sad if I do not do what I promised him.

Key to Exercise 34

1. ¿Cuántas circulares cupieron en el sobre? 2. ¿Supuesto (puesto) que le diésemos dos por ciento de descuento, cuando traería V. el dinero? 3. ¡No caiga V.! Se haría mal. 4. Antes que él venga, traiga V. toda la coleccion de muestras. 5. Suplico (pido) a V. me dé una idea como principiar esta carta tan difícil. 6. Entró con el sombrero puesto. 7. Le dije a él que pusiera (pusiese) el sombrero. 8. ¡Póngase V. bueno, si quiere vivir de sus rentas! 9. De miedo que cayéramos (cayésemos), no daremos un paseo hoy. 10. Fué necesario que cupieran (cupiesen) en la sala todas las personas convocadas.

Key to Exercise 35

1. Dear Sirs, The object of this letter is to enclose an order for you in various articles. 2. If my partner dies before me, the contract says that his share of the capital must remain in the concern. 3. I always fight shy of speculations of that hazardous nature. 4. It is necessary we should hear all that there is to be said on this matter on the part of the witnesses who have been summoned to appear next Wednesday. 5. Unless more is produced in industry and agriculture, it is certain that the financial situation will become as bad as ever it can. 6. Come what may, I tell you that I shall refuse to take part in that undertaking, for the reason that it is dangerous in the highest degree. 7. If we set out at the same time that I generally leave, we should arrive in Cadiz before nightfall. 8. In their letter, they refer to what we said in our last communication on this matter. 9. Referring to our contract of last December, I beg to remind you that you still have to deliver to me 300 pieces of twills, No. 427. 10. They said that in consideration of the scanty stocks of the article which there were in the market, they had sent a wire to their suppliers telling them to forward the whole of the stocks (spot goods) in that market.

Key to Exercise 36

1. Mi socio murió el año pasado y según las condiciones de nuestro contrato de sociedad, mandé sacar el balance de (saldar) los libros, mandando, también examinarlos, y entregué a su viuda la suma perteneciente a él. 2. Principié la carta así: "Muy Sres. y amigos míos: Al acompañarles extracto de su cuenta, siento tener que hacerles presente que la mayor parte (la mayoría) de las facturas mencionadas en él no fueron pagadas dentro del plazo convenido." 3. Vine ayer a la oficina (despacho, escritorio) y hallé (encontré) la puerta cerrada, por cuyo motivo tuve que llevar mi pedido en otra parte, circunstancia esta que, por lo que toca a V., siento en el alma. 4. Se nos notificó a nosotros que compareciéramos (compareciésemos) y que, como testigos, declarásemos (declaráramos) todo lo que supimos (sabíamos). 5. Aunque durante el año pasado se se produjo tres veces la cantidad acostumbrada de géneros, quedó un déficit enorme en el Tesoro Nacional. ¿A qué obedecerá esto? 6. Le aconsejo a V. que huya de tales especulaciones tontas, por apetecibles que parezcan los prospectos de las compañías que se quiere flotar. Ya se sabe que son destinados a producir este efecto en V. 7. Durma V. cuanto tiempo quiera, pero aténgase V. a las horas del negocio, venga lo que viniere. 8. ¿Qué diría V. si un cliente le pidiese que le abonara (abonase) 50% por presentar los géneros una diferencia muy ligera en el color (tono)? 9. Sírvase V. buscar en el mercado y ponernos un cable, diciéndonos lo que haya de disponible. A. C.

Continued from page 422.

GEOGRAPHY:

Contributors:—Robert Finch, F.R.G.S.; W. H. Koebel; Sir John Scott-Keltie, LL.D.; Cyril J. Silverston, B.Sc.(Lond.).

THE BRITISH ISLES.—VI

IRELAND, the second most considerable island of the group that forms the British Isles, is a little larger than Scotland. Broadly speaking it consists of a large central plain having mountainous or hilly districts on the north, west and south, but extending to the sea on the east between Dundalk and Dublin.

Irish Bogs

Owing to this basin-like conformation and the rather heavy rainfall the rivers are slow and numerous, lakes are plentiful and bogs are very prevalent. These bogs are a notable characteristic of the country and are really shallow stagnant lakes which have become filled up with sphagnum moss, heath, ferns and grasses which, decaying, have formed a stiff fibrous kind of mud. Occasionally this is firm enough to walk over, but there are many quagmires, and some of them, situated on slopes, have flowed down valleys as streams of liquid mud. When dried the peat, as this mass of decayed vegetable matter is called, can be burnt as fuel, when it has about half the heating power of coal. There are very many fertile districts, especially in Leinster, and the pasturage is rich and of a hue so vivid that it has gained for the country the title of the " Emerald Isle."

Politically Ireland is divided into four provinces: Ulster, Munster, Leinster and Connaught, of which the first named is the most populous and prosperous.

The province of Ulster occupies the northern portion of Ireland, and this differs greatly from the other three provinces chiefly owing to the fact that in the seventeenth century a large number of Lowland Scots settled there and founded important industries. The province depends therefore not entirely upon agriculture, as is the case of the rest of Ireland. These descendants of the Scots settlers are Protestant, whereas the great majority of the inhabitants of the rest of Ireland are Roman Catholics.

Physically a great part of Ulster is composed of igneous rocks, the most ancient of the stratified formations consisting of mountain masses in the counties of Down, Antrim, Londonderry, Donegal, etc.

The most important city of the province, and the largest in the island, is Belfast, the centre of the linen industry, which is carried on throughout the district. The flax used is both grown in the neighbourhood and imported from Russia and other countries. Belfast has large shipbuilding works and also rope manufactures, as well as distilleries. Some coal is derived from the counties of Antrim and Tyrone, but most is imported from Scotland.

The Giant's Causeway

In the county of Antrim the basalt which overlies the newer rocks is often developed into a columnar structure similar to that of the island of Staffa in the Hebrides. In the Giant's Causeway is a very famous example of this structure which is much visited by tourists, though it is common in other parts (*see* Vol. V., p. 255).

Londonderry is an old walled town noted for its siege in 1689. Donegal consists of ancient rocks and has fine cliff scenery, but the region and the inhabitants are very poor, the latter being engaged in small farms and in fishing.

The central plain of Ireland is mostly composed of Carboniferous limestone, from which the coal-measures have been almost entirely denuded. In many parts this is overlaid with bogs varying from a few to 50 feet in depth, the largest of which, in King's County and Meath, being the Bog of Allen. The bogs are clothed with grasses, heather, bog-myrtle, etc., but their appearance is monotonous, as animal life and trees are practically absent. The streams are dark brown in colour from the peat and generally sluggish, and the roads are straight causeways over the featureless surface.

On the east the plain extends to the coast, and here is situated Dublin, the capital of Ireland, at the head of a bay enclosed between

Howth Head on the north and the high ground of the Wicklow mountains on the south. The city stands on the river Liffey, which is here narrow enough to be easily bridged, and contains many handsome buildings and streets. The chief industries are the distillation of whisky and the brewing of "stout." Railways and canals radiate in all directions to the interior, and Dublin is consequently an important distributing centre both for imports and for exports. The mail steamers from England run between Dublin or Kingstown and Holyhead in Wales.

The eastern part of the plain is fertile and produces much live stock and dairy produce. In the centre of Ireland are only small market towns such as Mullingar and Athlone; Drogheda and Dundalk are ports with a certain amount of export trade in agricultural produce, etc. The former is at the mouth of the Boyne, a river passing through a district rich in antiquities and historical associations. On the Hill of Tara, in Meath, dwelt in ancient times the Kings of Ireland.

Achill Island

At the western side of the plain near the head of the estuary of the Shannon stands Limerick, the great port of western Ireland, exporting dairy produce and bacon, which is cured there. Sligo and Galway are both ports with a considerable fishing industry.

The coast of Connaught is very fine and of a character like that of the west of Scotland, there being frequent and precipitous cliffs, narrow fiord-like openings and many islands. Many tourists visit Achill Island for the sake of the fine cliff scenery (*see* Plate facing p. 9).

The south of Ireland forms the province of Munster and part of Leinster. It is generally fairly hilly and even mountainous, the hills in the south-west having an east and west direction and separating the valleys of the rivers Bandon, Lee, Blackwater and Suir; as we pass eastward, however, the rivers flow north and south.

At the mouths of the rivers are the fine natural harbours of Kinsale, Youghal, Waterford, Wexford and Cork, the latter being at the head of the inlet, on an island in which is Queenstown, a place of call for the steamers plying between England and America. These ports all enjoy a considerable export trade in dairy produce, cattle, etc.

The deep indentations on the south-west coast, Bantry Bay, Kenmare River and Dingle Bay, are the ends of submerged valleys, and the coast scenery hereabouts is very fine. From Valentia Island off County Kerry a cable is laid to Newfoundland.

In County Kerry also is the beautiful district of the Lakes of Killarney, situated at the foot of the Macgillicuddy's Reeks, which include Carntual, the highest mountain in Ireland, nearly 3,500 feet high. Parts of Tipperary are very fertile and wheat is cultivated between Limerick and Cashel, which latter small town has a remarkable isolated rock on which are the ruins of a castle and a cathedral. At Kilkenny there is a large castle and a fine cathedral, and a considerable trade in corn is carried on there.

To the south of Dublin, in Wicklow, are the beautiful Wicklow mountains formed of granite and pierced with deep glens of remarkable beauty. Particularly fine are the Vale of Avoca and the Vale of Avonmore at Glendalough, with its interesting ruins of seven churches and a round tower. In this county is Bray, the well known and popular resort of the inhabitants of Dublin.

British Trade

The trade of the British Isles may be considered as being of a threefold nature; the imports, the exports, and the exports in the same state as that in which we received them, of imported goods.

Of imports the chief are food and raw materials. The most important of these are grain and flour, meat and animals, butter, tea, tobacco, raw cotton, raw wool, timber, silks, oil seeds, chemicals, and leather both manufactured and unmanufactured. Among articles exported are coal, manufactured iron and steel, including machinery, manufactures of other metals, cutlery, cotton goods, woollens, clothing, chemical manufactures of various kinds, railway wagons and carriages, motor-cars and cycles.

There is always a considerable balance of imports over exports, accounted for by the facts that, in the first place, Great Britain had much money invested in foreign countries, and the balance is partly due to us as interest on the capital invested, and in the second place to the enormous carrying trade of our mercantile marine, which, being paid for, forms a kind of "invisible export."

Communications within the British Isles are uniformly good and plentiful. Owing to the absence of high mountain ranges the construction of railways has been rendered easy. So easy and quick has it been that communications by canal and river have been allowed in great measure to fall into decay, and this has not tended to the good of the country as a whole. The process has been

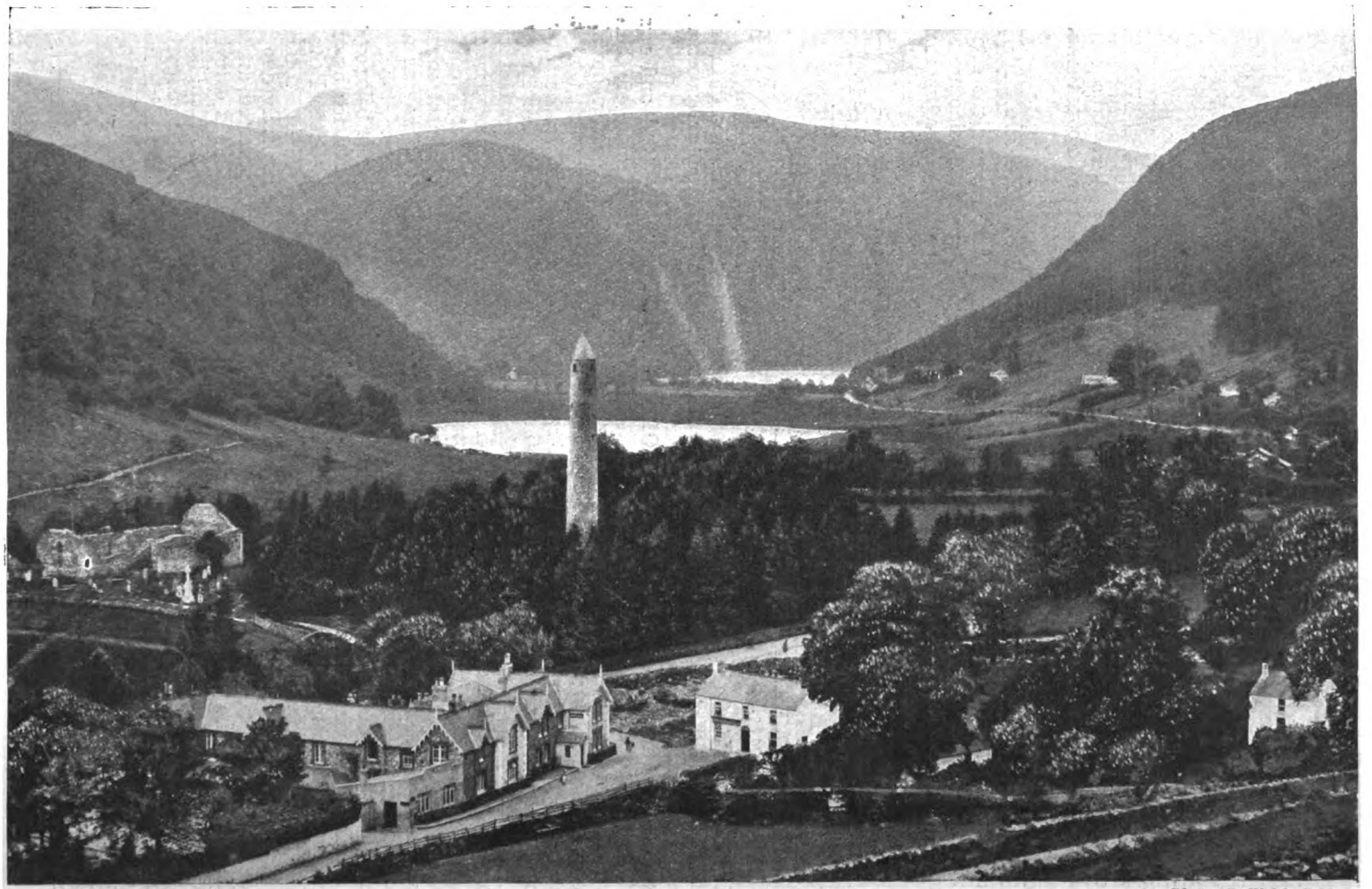


Photo: R. Welch, Belfast

GLENDALOUGH,

with its Round Tower, ruins of St. Saviour's Monastery, lake and cincture of hills, is the city of St. Kevin. Before St. Kevin's death (618), it had attained great reputation as a seat of learning.

facilitated by the acquisition of many of the canals by the railway companies, who have been unwilling to encourage a rival method of transport.

British Railways

The railways of Great Britain radiate out from London as a centre in all directions. To the south-east run the South Eastern and Chatham and the London, Brighton and South Coast Railways. These serve the counties of Kent, Surrey and Sussex. To the southern counties runs the London and South Western Railway, the main line running through Salisbury to Exeter and then onwards through Devon to Plymouth and Cornwall. The Great Western Railway, following for some distance the line of the Thames, runs to Bristol and Exeter and serves the greater part of the south-western promontory of Devon and Cornwall. Another branch extends into South Wales, where from Fishguard a line of steamers communicates with Ireland. Yet another branch diverges to the north-west through Birmingham to Shrewsbury and Birkenhead. The London and North Western main line runs through Rugby and Stafford to Crewe, and then, with branches to Liverpool and Manchester, goes north to Carlisle, where it joins with the Scottish railways to Glasgow, Edinburgh, etc.

A branch also diverges at Crewe to pass along the North Wales coast, where at Holyhead is the terminus of the chief line of packet steamers for Ireland. The Midland Railway and the Great Central Railway feed the midland districts and the manufacturing regions of south Yorkshire. The Great Northern Railway runs to York, where it joins with the North Eastern Railway, affording an alternative route into Scotland east of the Cheviot Hills. The eastern counties are fed by the Great Eastern Railway.

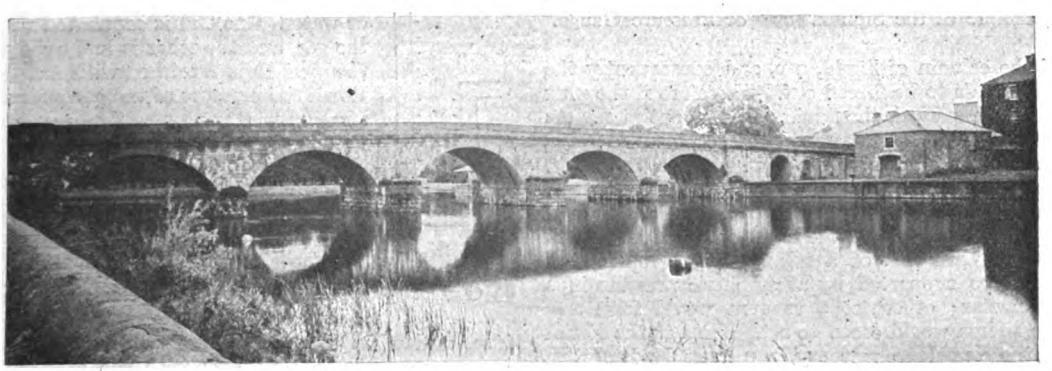
In Scotland the mountainous nature of the land and the sparseness of the population, except in the lowland district, has made the railways less easy to construct. The principal line following the eastern lowland belt passes through Aberdeen to Inverness and thence as far north as Thurso and Wick. The western highlands are almost unsupplied by railways, there being but two branch lines that touch the coast.

Navigable Rivers and Canals

In Ireland the railways radiate from Dublin, the principal main lines being those from that city south, to Cork; west, to Galway; and north, to Belfast and Londonderry.

The navigable rivers and canals of England and Wales amount to some 5,000 miles in length, of which over 3,000 are canals. The Bridgewater canal system and the Manchester Ship Canal in Lancashire are among the most important, and the Gloucester and Berkeley Ship Canal connecting the former city with the Severn is also to be noticed. In Scotland the Forth and Clyde Canal constructed in the year 1790 is commercially the most important; the Caledonian Canal passing through Glenmore, and the Crinan Canal across the Mull of Kintyre being mostly used for tourist traffic. A ship canal has been proposed between the Forth and the Clyde.

In Ireland two canals connect Dublin with the Shannon, and a through line of navigation connects Belfast by the Ulster Canal with Leitrim and the upper reaches of the Shannon. C. J. S.



CARRICK-ON-SHANNON,

on the upper reaches of Ireland's greatest river and near the famous Abbey of Boyle, the largest and most impressive of the old monasteries.

Continued from page 431.

MATHEMATICS:

Contributor: **—ARITHMETIC, ALGEBRA, GEOMETRY, CO-ORDINATE GEOMETRY, TRIGONOMETRY, MECHANICS, MENSURATION, ETC.**
(M. A. Lewenz, M.A.[Lond.]).

HYDROSTATICS.—V

Pneumatic Instruments

35. **The Siphon.**—This consists of a bent tube with two unequal limbs, and is used for drawing liquid from vessels which have no opening at the bottom. The action depends on atmospheric pressure.

The siphon is first filled with the liquid to be drawn off, the ends being temporarily closed with plugs; the shorter arm is then plunged into the vessel and the plug at A is removed. If a horizontal plane continuous with the surface of the liquid in the vessel cut the shorter arm at F and the longer arm at G, then it is clear that the pressure at F is the same as that at G, each being equal to atmospheric pressure. Hence the pressure inside the tube on the plug at B is greater than the pressure outside, i.e. the atmospheric pressure, by the weight

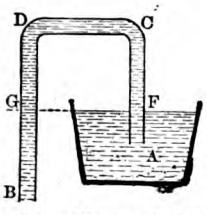


Fig. 24.—Illustrating the principle of the Siphon.

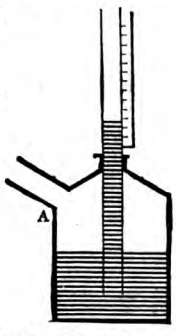


Fig. 25.—Manometer or Pressure Gauge.

of the column of liquid, G B, and consequently the plug tends to be forced out. Therefore if the plug at B be removed, the liquid will flow out at B. As the liquid flows out at B the atmospheric pressure on the free surface of the liquid in the vessel will force liquid up the arm, A C, thus no vacuum will be formed, and there will be a continuous flow of liquid from A to B. Note that the height, F C, must be less than that of a column of the liquid that would be supported by atmospheric pressure in a barometer; otherwise a vacuum would form and the siphon would cease to act. Thus if the liquid in the vessel be mercury, F C must be less than 76 cm.

36. **Manometers or Pressure Gauges.**

The Barometer Gauge or simplest form of manometer consists of a long narrow tube with a scale attached, which fits into a strong vessel containing mercury. The upper end of the tube is left open, and the box or flask communicates by means of the pipe A with the steam whose pressure is to be measured. As the pressure of the steam increases and exceeds the atmospheric pressure, the mercury is forced up the tube, and the pressure may be calculated from the reading on the scale. This manometer is unpractical for the reading of very high pressures, as for each atmospheric pressure a length of 30 inches of tube is required, which makes the instrument unwieldy.

Compressed Air Manometer. — This consists of a straight or bent tube containing air at ordinary atmospheric pressure at one end, which is closed, and furnished with a scale. Some mercury separates the air from the open end of the tube which communicates with the gas or steam whose pressure is to be measured. As the pressure increases above atmospheric pressure, the volume occupied by the air at the closed end decreases inversely as the pressure, and consequently the pressure can be read off from the scale.

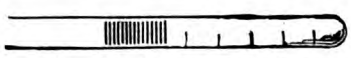


Fig. 26.—Compressed Air Manometer.

The Siphon Gauge.—This is used for small pressures. It consists of a bent tube open at both ends, and is half filled with mercury or water. One end is connected with the gas, and the other is left open to the air. It is furnished with a scale. When the pressure of the gas exceeds atmospheric pressure, the mercury rises in the tube open to the air, and the excess of the gas pressure over atmospheric pressure is read by the difference in level of the mercury in the two arms.

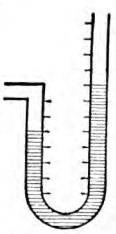


Fig. 27.—Siphon Gauge.

37. **The Diving Bell.**—This is a large bell-shaped vessel, open at the bottom. It is usually made of iron, and when lowered vertically into the water is heavy enough to sink, even with the air inside it. As the bell descends the pressure on the air increases and the water rises higher and higher inside the bell. To enable men to work inside it, air at ordinary atmospheric pressure is pumped

into the bell by means of a tube A, the superfluous air bubbling out at the bottom.

Pumps

38. Pumps for liquids.

(1) The **Common Pump** consists of a cylinder connected with the well by a pipe, A, at its bottom, which is closed by a valve, B, opening upwards. In the cylinder is a closely fitting piston, P, which can be raised or lowered by a rod, R, to which is attached a lever, H. The piston also contains an opening closed by a valve, C, opening upwards. The cylinder has a spout, S, and the top is open to the air.

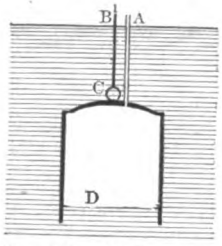


Fig. 28.—Diving Bell.

Suppose the cylinder is full of water and the piston, P, is at the bottom. If you pull H down, the piston will be pulled up, the pressure below the piston is therefore diminished, and the water in the well will force the water up A through B into the cylinder. C will remain closed. As the water above P is raised, it flows out of the spout, S.

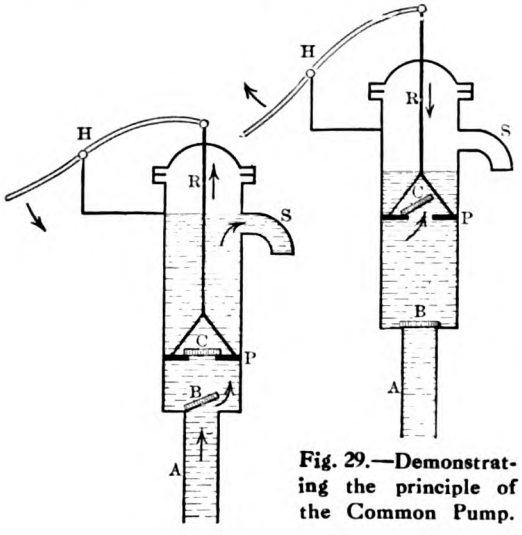


Fig. 29.—Demonstrating the principle of the Common Pump.

If you push H up, the piston will be forced down, B will be closed by the pressure of the water above it, while C will be opened by the pressure of the same mass of water which will pass through C to the top of the piston P.

A similar pump is used to lift water out of mines. It is placed at the bottom in the mine, and the water is expelled at the top of the shaft.

In this **Lift Pump** the top of the cylinder is closed, and the piston passes through a collar; from the lid a pipe, F, passes upwards to the required height, and it has a valve, D, opening upwards at the bottom. It will be clear from the diagram how this pump acts.

(2) **The Forcing Pump.**—In this the piston has no valve, but the pipe, F, attached to the cylinder has a valve, C, opening into the pipe. When the piston is pushed down the water is forced through C into the pipe and up it.

Clearly these pumps do not act continuously, but the flow stops when the motion is reversed. To obtain a continuous flow a forcing pump is often provided with an air chamber, K, made of metal. When the piston moves rapidly water enters K faster than it can escape, and consequently the air in K is compressed. During the upward stroke of the piston, the air tends to expand and consequently forces the water out of F.

In the steam fire engine we have a double forcing pump; each pump is connected with K, and the lever worked by steam, which controls the pistons, and acts so that one piston rises while the other descends.

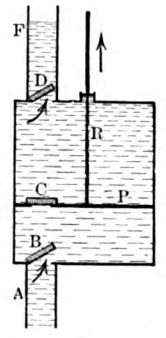


Fig. 30.—Lift Pump.

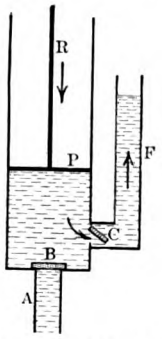


Fig. 31.—Forcing Pump.

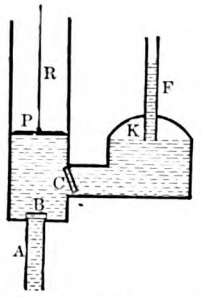


Fig. 32.—Continuous Forcing Pump.

39. Air Pumps.—Pumps for compressing air, or for removing it from a vessel, are in principle the same as those described in § 38. Very often the term air pump is applied to an instrument which exhausts air.

The exhausting pump (Fig. 33) consists of a cylinder with a chamber, A, attached. The pipe connecting the cylinder with A is closed by a valve, B, opening upwards, and the piston also has a valve, C, opening upwards.

Supposing the chamber to be filled with air, during the upstroke C remains closed owing to the pressure of the air outside, the air from A rushes through the pipe F, pushes open B, and fills the space between the piston and the bottom of the cylinder. At the beginning of the down stroke of the piston, C is closed, and the pressure on the air between P and the bottom of the cylinder closes B. As soon as the pressure of the air exceeds atmospheric pressure, it opens the valve C and rushes out of the cylinder and escapes. The process is repeated until A is exhausted of air.

In the **Condensing Pump** the valves open in the reverse sense (Fig. 34), consequently with each down stroke air is forced through B into A, while during the up stroke B is closed by the pressure of the air in A, while air at atmospheric pressure passes

through c into the space between the bottom of the cylinder and the piston.

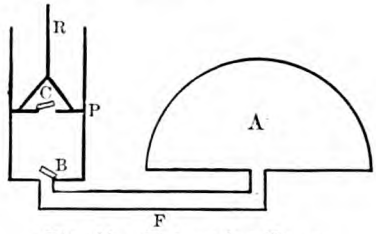


Fig. 33.—Exhausting Pump.

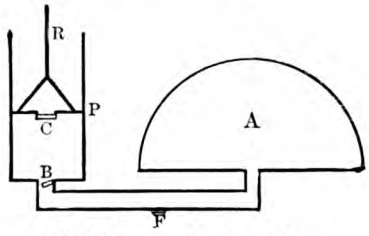


Fig. 34.—Condensing Pump.

40. Examples :—

(1) A diving bell whose capacity is 200 cb. ft. is lowered in water till its mouth is at a depth of 50 ft. below the surface. How much air at ordinary atmospheric pressure must be pumped in so that all the water may be driven out ?

Let V = volume which the air filling the bell would occupy at atmospheric pressure.

Pressure of atmosphere = that due to 34 ft. of water.

Pressure inside bell = that due to (34 + 50) ft. of water.

Volume actually occupied by air = 200 cb. ft.

Hence by Boyle's Law

$V \times 34 = 200 \times 84$

$\therefore V = \frac{200 \times 84}{34} = 494\frac{1}{8}$ cb. ft. approximately.

Hence $494\frac{1}{8} - 200 = 294\frac{1}{8}$ cb. ft. of air at atmospheric pressure must be pumped in.

(2) One foot of the length of the cylinder of a common pump holds 10 lbs. of water. At each stroke the piston works through 4 inches, and the spout is 20 ft. above the surface of the water in the well. How many ft.-lbs. of work are done at each stroke ?

At each stroke $10 \times \frac{4}{12}$ lbs. are raised through a height of 20 ft.

Hence work done $= 10 \times \frac{4}{12} \times 20 = \frac{200}{3}$

$= 66\frac{2}{3}$ ft. lbs.

(3) Find the force required to lift the piston of a common pump (neglecting the weight of the piston) if its sectional area is 4 sq. cm. and its spout is 20 ft. above the surface of the water in the well.

Let x in. be depth of piston below the spout.

Let h in. be height of the water barometer.

Then pressure above the piston is due to weight of a column of water $= (h + x)$ in.

and pressure below is due to the weight of a column of water $= \{h - (20 \times 12 - x)\}$ in.

Hence the difference of pressure is that due to weight of a column of water

$= [h + x - \{h - (20 \times 12 - x)\}]$ in. $= 240$ in.

Hence difference of pressure on each side of piston $= \frac{240}{1728} \times \frac{1000}{16}$ lbs. wt. per sq. in.

$\therefore$ resultant force on piston $= \frac{4 \times 240 \times 1000}{1728 \times 16}$

$= 34\frac{3}{18}$ lbs. wt.

(4) To find the density and pressure of the air in the receiving chamber of a condensing pump after n complete strokes.

Let A = volume of receiver.

B = volume of cylinder or barrel.

D = density of air of the atmosphere.

d = density of air in receiver after n strokes.

The mass of air orginally contained in receiver = A × D.

At each backward stroke of the piston a volume B of air of density D enters the receiver.

Hence after n complete strokes the mass of air pumped into receiver = $n \times B \times D$.

Therefore total mass of air in receiver after n strokes = $(A + nB)D$.

The density d of this air $= \frac{\text{mass}}{\text{volume}} = \frac{(A \times nB)D}{A}$

$= \left(1 + \frac{nB}{A}\right)D.$

Exercise 7

Miscellaneous examples from London Matric. Exam.

(1) A block of wood measuring 9 × 8 × 6 cm. is immersed in water with a 9 × 8 cm. face horizontal uppermost, and 12 cm. below the surface. Find the pressure on each face in magnitude and direction. Show that the result is in harmony with the principle commonly known as that of Archimedes.

(2) A long thin stick of uniform cross-section and density has a bullet, of weight equal to its own, attached to one end, and floats half immersed in a vessel of water. Show that it is in neutral equilibrium.

(3) Mercury is poured into a U tube which has a section of one sq. in., and which is standing with its limbs vertical so as to more than occupy the bend ; 20 cb. in. of water are then poured into one limb. Through what height will the mercury rise in the other ? (Specific gravity of mercury = 13·6)

(4) A hollow cylinder 12 in. long fitted with an air-tight piston is just full of air at atmospheric pressure when the piston is put in. Find the pressure exerted by the air after the piston has been pushed in 2 in., 3 in. and 9 in. respectively. If the area of the piston is 3 sq. in., find the force needed to push the piston 9 in. into the cylinder. (Atmospheric pressure = 15 lbs. wt. per sq. in.)

Key to Exercise 6

(1) $1\frac{1}{14}$d. (2) 40 ch. cm. (3) 8749 yds. approximately.

Key to Exercise 7

(1) Pressure on upper face 864 gms.wt.
Pressure on lower face 296 gms. wt.
Pressure on either 8 × 6 face 720 gms. wt.
Pressure on either 9 × 6 face 810 gms. wt.
Pressure everywhere is perpendicular to the faces towards the inside of the block.

(3) $\frac{25}{64}$ inches.

(4) 18 lbs. wt. per sq. in. ; 20 lbs. wt. per sq. in. ; 60 lbs. wt. per sq. in. ; 135 lbs. wt. M. A. L.

Continued from page 441.

BUSINESS AND COMMERCE

Contributors:—BOOK-KEEPING (Frederick Heelis, F.C.I.S.). SHORTHAND (by arrangement with Pitman's Schools). COMMERCIAL TRAINING (Arthur Brooke). CHOOSING A CAREER (A. C. Marshall).

SHORTHAND.—XXV

The Acquisition of Speed.—The student having now covered the theory of the system, it behoves him to turn his knowledge to practical purposes, namely, the acquirement of speed, and we shall conclude this series of lessons with a few hints which we trust will help him to attain what has no doubt been his ambition throughout the course—the ability to write at a speed which will enable him to record in shorthand the words of a speaker.

Pitman's and Speed.—Of one thing he may be certain, and that is that the system he has been studying is capable of the highest results. Pitman's Shorthand has been thoroughly tested in every branch of stenographic work, and no one can say that it has been found wanting. Not only in practical, everyday work has the wonderful speed capacity of the system been demonstrated, but also in public speed examinations conducted under most stringent rules, and in the presence of committees of responsible men. In such tests candidates have proved beyond all doubt that in Pitman's Shorthand they can take down unfamiliar matter dictated at 200, 210, 220, 230, 240, 250 and even at the wonderful speed of 300 words a minute, for periods varying from five to ten minutes, and afterwards transcribe their notes with accuracy. Such results could only be obtained from a system capable of perfect legibility even when written at the highest speeds. On this point, therefore, the student can rest assured—the System is right,—and it remains with him to persevere in his endeavours to "ply the wingèd pen."

As is the case in longhand writing, rapid writing in shorthand depends to a very great extent on the manner in which the pen is held. It is not easy to lay down a hard-and-fast rule on this point, but the writer should aim at securing perfect freedom of movement for his hand. That is most important, and any method of manipulation that does not give this feeling of freedom has a retarding influence, and renders high speed well-nigh impossible. The writer who would reach the higher planes of shorthand writing should, therefore, be especially careful to cultivate a correct style.

It is essential that the wrist should not be allowed to rest on the desk or the note-book. The right arm should rest on the edge of the desk at a distance of about six inches above the wrist, with the elbow nearly touching the side of the body. The movements of the pen should be governed chiefly by the first and second fingers and the thumb.

Some writers are faithful to a good pencil for reporting work, but the majority are in favour of the fountain pen. As, however, occasions may arise when only a pencil is available the writer should accustom himself to the use of both.

Size of Shorthand.—It will be found that there is as much "character" in the shorthand as there is in the longhand writing of an individual, so that there can be no fixed rule on the "style" of writing; but, allowing for characteristic tendencies, it should be pointed out that it is inadvisable to write the outlines too small, as this may result in confusion between half-length and full-length strokes. It is equally undesirable that a very large size of writing should be cultivated, as to a great extent the freedom of movement that is gained is generally more than counteracted by the necessity of having to return to the beginning of a new line after every three or four words. The resultant frequent turning over of the leaves of the notebook is another objection to the very large style of writing. The "happy medium" should be aimed at, and a style a trifle larger than the printed shorthand in *Pitman's Journal* and *Pitman's Shorthand Weekly* may be suggested.

How to Practise.—When a good knowledge of the theory has been acquired, the services of a kindly disposed friend or relative should be enlisted for the purpose of dictating. Many books are published containing suitable matter counted ready for dictation, and the use of these would save considerable time and trouble. There should be no undue hurry at this stage, and a speed well within the capabilities of the writer should be maintained. It is at this point that the young writer's shorthand begins to mould itself into characteristic form, and it is therefore essential that a neat and fluent style be cultivated. The writer will be well repaid for the effort.

Apart from practice at home, there are many other opportunities for increasing one's speed; for instance, there are Evening Schools, Commercial Schools and Technical Institutes, while in many towns there are Shorthand Associations where dictation practice may be obtained.

It is highly important that *every passage dictated should be read*, and a certain portion neatly and carefully transcribed. Any outline that has caused hesitation or that looks awkward or doubtful should be looked up in the Shorthand Dictionary, which contains the outlines for some 70,000 words.

Transcripts should be carefully compared with the original, and the reason for any errors inquired into. Plentiful practice on these lines will do much towards assisting the student to the high-speed goal.

The passages chosen should be as varied as possible, as it is essential that a shorthand writer worthy of the name should be able to deal in an able and satisfactory way with matter of almost any description, as it must be borne in mind that success as a speed writer depends in a large measure on ability to write without hesitation the most facile outline for both common and uncommon words.

The attempt to record the utterances of public speakers should be deferred until a fair speed has been acquired, say 90 words a minute, when an effort might be made to take down the words of a slow and deliberate speaker. If on such occasions it is found that the delivery of the speaker is too fast, the young writer should not be discouraged and close up his note-book. Instead he should make a point of recording as many complete sentences as possible, omitting the intermediate sentences.

Repetition Matter.—Some writers are in favour of what is termed " repetition matter " as an aid to speed ; i.e. the writing of the same passage many times from dictation, the speed being gradually increased at each reading. It may be that after many attempts the speed of writing for the particular passage may have increased from say 60 to 90 words a minute, but it would be foolish on the part of the writer to form the impression that he can now write at 90 words a minute. What is gained from such practice is a certain amount of manual dexterity, and that in itself is a decided gain. But we repeat that the writer should be under no illusion as to his rate of speed on ordinary matter.

Reading Practice.—The importance of reading shorthand as an aid to speed cannot well be overestimated, and every opportunity should be taken to *read and copy* from printed shorthand. In this way a wide knowledge of outlines is acquired—a knowledge on which speed in a very great degree depends—while the careful copying of selected passages does much to assist in the cultivation of a neat and legible style, the real value of which will be fully appreciated when more serious work is undertaken. High speed writers are practically unanimous in expressing their strong belief in the immense benefits to be derived from the reading of correctly written shorthand. *Pitman's Journal* and *Pitman's Shorthand Weekly* provide good material for such practice, as will also the many books now obtainable in the well-known characters of Pitman's Shorthand.

Speed Certificates.—It is but natural that the enthusiastic writer should from time to time be desirous of knowing the speed at which he is able to write, so that he may mark his progress. The most satisfactory method of ascertaining this information is to sit at one of the numerous Speed Examinations which are frequently held. The majority of public examinations are held annually, but the Pitman Examinations may be held at any time and place where a responsible and approved committee can be organised. Writers can in this way be tested at any speed from 50 words a minute upwards. Those desirous of obtaining such certificates should communicate with the Examinations Department, Phonetic Institute, Bath, for particulars.

The possession of a certificate for a good speed, apart from giving additional confidence to the writer, carries considerable weight when the possessor is making application for a post. Such a certificate, also, is valuable in that it not only indicates that the possessor is capable of writing shorthand accurately at a certain rate of speed, but also because the necessary training brings with it an improvement in various other directions. He will probably find that his vocabulary has been greatly enlarged, his knowledge of spelling improved, and his general knowledge greatly strengthened. It has also no doubt developed his powers of concentration and perseverance, and in many other ways rendered him more fitted for the work that lies before him. To obtain a speed certificate should therefore be the aim of those students who have followed this course of lessons. There is certainly nothing to be lost, and a great deal to be gained, by the effort which is necessary to secure one. And it may seem unnecessary to add that the higher the speed attained, the greater will be the value of the certificate.

The Value of High Speed.—It is natural that the student should be anxious to know what speed will be required of him in commercial life, and we would point out that the higher his speed the more fitted is he to undertake any kind of work that may fall to his lot as a shorthand writer. Some men may dictate at the slow rate of 70 or 80 words a minute, while others who think more rapidly may reach 140 to 150 words a minute. Generally speaking the rate of 130 words a minute will meet the requirements of the majority of business houses, but there are many firms in which a much higher rate of speed is absolutely necessary. The moral to be drawn, therefore, is to practise assiduously that you may attain the highest speed of which you are capable, and so be ready to take advantage of any opportunity for advancement that may arise. In conclusion we reiterate the golden maxim—*Speed comes only from practice.*

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